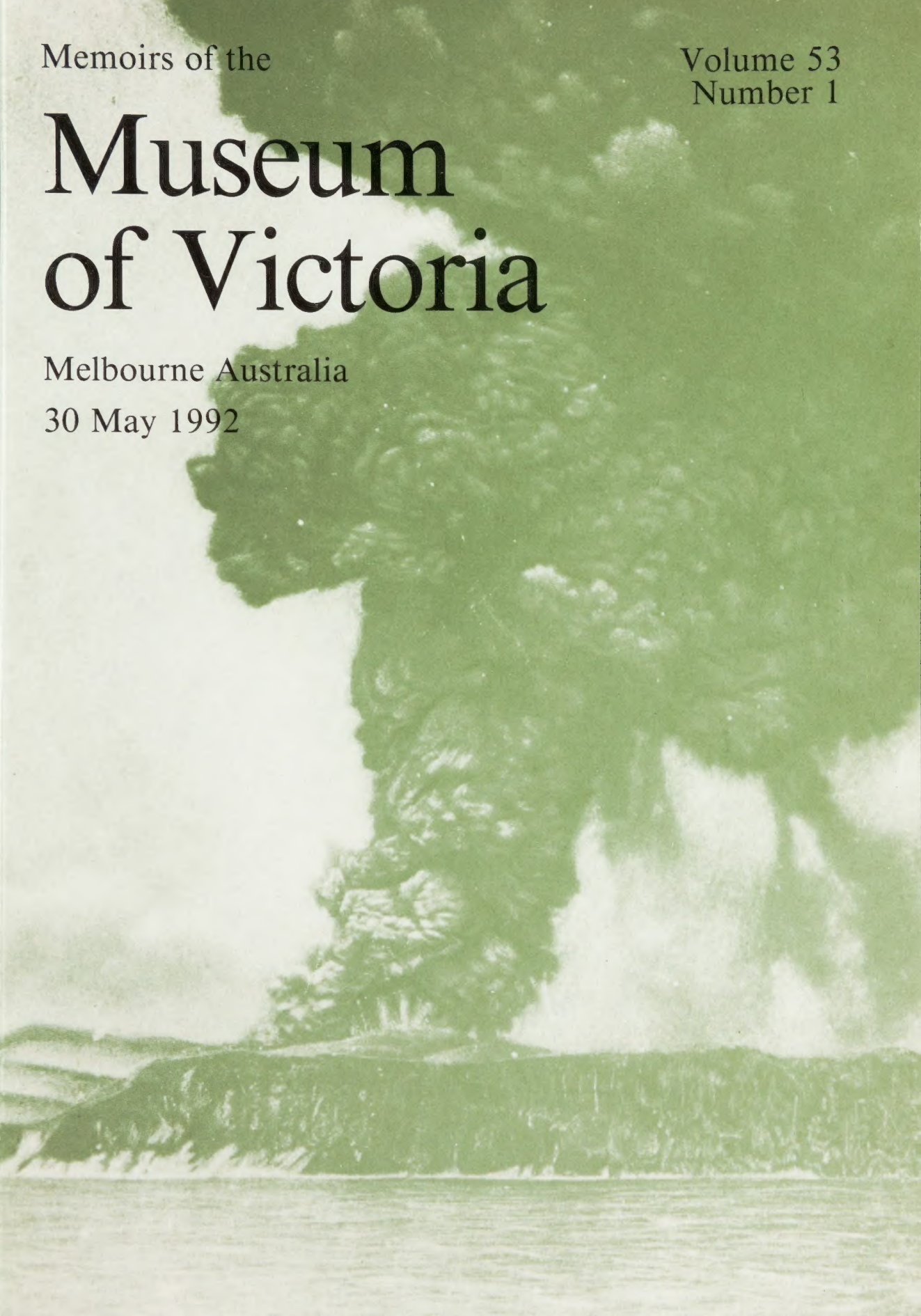
Memoirs of the

Volume 53
Number 1

Museum of Victoria

Melbourne Australia

30 May 1992



Cover. Photograph of the eruption of Krakatau Island, Indonesia, taken one week after its start on 27 May 1883. The *Memoirs* continues in this issue its series of papers on the recolonising fauna with contributions on insects of the Thysanoptera, Hymenoptera and Collembola.

ISSN 0814-1827

MEMOIRS

of the
MUSEUM OF VICTORIA

MELBOURNE AUSTRALIA

Memoir 53
Number 1
30 May 1992

PUBLISHED BY ORDER OF THE COUNCIL

Instructions to Authors

The Museum of Victoria was formed in 1983 by the merger of the National Museum of Victoria (established in 1854) and the Science Museum of Victoria (established in 1879). Among the Museum's objectives are scholarship and education in the fields of natural history, science and technology, and history of human society. The Museum of Victoria publishes three scientific serials to further these objectives, *Memoirs of the Museum of Victoria* (until 1983 *Memoirs of the National Museum of Victoria*), *Memoirs of the Museum of Victoria (Anthropology and History)*, and *Occasional Papers from the Museum of Victoria*.

The two *Memoirs* series publishes papers on original research in the natural sciences on one hand, and anthropology and history on the other, pertinent to Victoria and/or the Museum's collections. All contributions are assessed by independent referees before publication.

The *Occasional Papers* are research documents of sufficient importance to be preserved but which are not appropriate for primary scientific publication. Papers are factual rather than interpretative studies, may be of special local interest, or may be longer than a normal scientific paper. Contributions will be refereed if appropriate.

Two copies of the manuscript with accompanying plates and figures should be submitted to the Scientific Editor, Museum of Victoria, Swanston Street, Melbourne, Victoria 3000. Authors should consult a recent volume of the *Memoirs* to aquaint themselves with format.

Manuscripts must be typed on A4 paper, double-spaced, on one side of the paper and with ample margins. Except for short papers (less than 10 manuscript pages) presentation of the final manuscript on word-processor floppy disks is essential. Papers should be arranged as follows: title (including higher classification of zoological taxa); authors' names and addresses; abstract; contents (only if the paper is very long); introduction and main text; acknowledgements; references; index (only if very long); and tables. Captions to text figures and plates must be attached to the manuscript as final pages. Underlining in the text should be restricted to generic and specific names. Measurements must be in the metric system (SI units).

References should be listed alphabetically at the end of the manuscript. Journal titles must be in full. References to books must give the year of publication, edition, name of publisher and city of publication.

In taxonomic papers synonymies should be of the short form: taxon, author, year, pages, figures. A period and dash must separate taxon and author except in the case of reference to the original description.

Photographs must have clear definition and may be submitted as either glossy or flat prints at the actual size for reproduction. Line drawings for text-figures should be in black ink on white card or drawing film. Maximum full-page size is 140 mm wide by 193 mm; single column width is 67 mm. Clear lettering must be inserted. Original drawings up to twice final size are acceptable.

CONTENTS

Paracalliope, a genus of Australian shorelines (Crustacea: Amphipoda: Paracalliopiidae).
J. L. Barnard and M. M. Drummond 1

A new species of *Pagurixus* (Crustacea: Decapoda: Paguridae) from southern Australia.
S. W. Gunn and Gary J. Morgan 31

Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species. Part IV. *Lophopagurus* McLaughlin and *Australeremus* McLaughlin.
Patsy A. McLaughlin and S. W. Gunn 43

Revision of the genus *Cheiloxena* Baly (Coleoptera: Chrysomelidae: Eumolpinae).
C. A. M. Reid 101

Thysanoptera (Insecta) from the 1985 and 1986 Zoological Expeditions to the Krakataus, Indonesia.
Richard zur Strassen 115

Rhoptromyrmex rawlinsoni sp. nov., a new apparently workerless parasitic ant from Anak Krakatau, Indonesia (Hymenoptera: Formicidae: Myrmicinae).
Robert W. Taylor 125

Paronellid Collembola collected by the Krakatau Expedition, 1984.
Ryozo Yoshii 129

Replacement name for *Lyria mitraeformis crassicostata* Darragh, 1989.
Thomas A. Darragh 135

Memoirs of the Museum of Victoria 53(1): 1–29 (1992)

PARACALLIOPE, A GENUS OF AUSTRALIAN SHORELINES (CRUSTACEA: AMPHIPODA: PARACALLIOPIIDAE)

By J. L. Barnard[1]* and M. M. Drummond[2]

[1] Department of Invertebrate Zoology, NHB-163, Smithsonian Institution, Washington, DC 20560, USA
[2] Department of Crustacea, Museum of Victoria, Swanston Street, Melbourne, Victoria 3000, Australia

Abstract

Barnard, J.L. and Drummond, M.M. 1992. *Paracalliope*, a genus of Australian shorelines (Crustacea: Amphipoda: Paracalliopiidae). *Memoirs of the Museum of Victoria* 53: 1–29.

Species of *Paracalliope* are widely distributed along south-eastern open-sea shores, brackish inlets and certain freshwater streams of Australia. We describe here extensive collections ranging from southern Queensland through New South Wales and Tasmania to western Victoria. The identity of *Pherusa australis* Haswell (1880) is now confirmed from numerous topotypic collections, at Cape Banks, as the first species of *Paracalliope* described from Australia and as the senior synonym of *Paroediceropsis raymondi* Fearn-Wannan (1968). *Paracalliope larai* Knott (1975), a freshwater Tasmanian species, is re-examined and partially re-described. A third mostly marine and widespread new species, *P. lowryi*, is described and a fourth species, *P. vicinus*, also new, with quite variable brackish-freshwater habitat, is described in numerous collections from Tasmania.

Introduction

The Paracalliopiidae were established by Barnard and Karaman (1982) to include *Paracalliope* Stebbing, 1899, and *Indocalliope* Barnard and Karaman, 1982. Later, *Katocalliope* Barnard and Drummond (1984), *Doowia* Barnard and Drummond (1987) and *Yhi* Barnard and Thomas (1991) were added to the group. The family is now revised to include species from Australia which heretofore have not been properly examined. The earliest known species from Australia, *Paracalliope australis* (Haswell, 1880), is properly described for the first time, *P. larai* Knott is reviewed and two new species are described.

Most species of the Paracalliopiidae have an affinity for brackish water or occur in freshwater or very shallow marine waters along shores, mainly in high tidepools. Their known distribution extends from India to Australia, New Zealand, New Caledonia, and Fiji.

Most of our material comes from Victorian surveys (Western Port and Port Phillip Bay), from Gippsland lakes or from various brackish lagoons and river mouths in New South Wales, Tasmania and Queensland. Collections are in the Museum of Victoria (NMV), The Australian Museum (AM), Queensland Museum (QM) and Tasmanian Museum (TM). Many replicate samples have been identified but only one from each locality is reported here. Maps and station localities for most of the Victorian material are found in Barnard and Drummond (1976, 1978, 1979, 1982).

The Paracalliopiidae and *Paracalliope* are newly diagnosed, with lists of their taxa. Three keys to genera of the family were given by Barnard and Thomas (1991) and a key to the species of *Paracalliope* is given here. Numbers in square brackets are geographic codes listed in Barnard and Barnard (1983).

Specimens of *Paracalliope* are frequently very difficult to handle because they break up easily and preserve poorly. For the most part, the manipulation of specimens is very tedious and frustrating because of these difficulties.

Legends

Capital letters in figures refer to parts; lower case letters to left of capital letters refer to specimens and to the right refer to adjectives as described below: A, antenna; B, body; C, coxa; D, dactyl; E, epimeron; F, accessory flagellum; G, gnathopod; H, head; L, labium; M, mandible; P, pereopod; Q, calceolus; R, uropod; S, maxilliped; T, telson; U, upper lip; V, palp; W, pleon; X, maxilla; Y, gill; Z, oostegite; d, dorsal; l, left; o, opposite appendage to nearby figure; r, right;

* Jerry L. Barnard died on 16 August 1991 shortly after this manuscript was accepted for publication.

s, setae removed and marked with circles-ovals.

Paracalliopiidae Barnard and Karaman, 1982

Diagnosis. Body plan ordinary but urosomites 2–3 fused together; shape of head ordinary, rostrum and sinus for antenna 2 ordinary, eyes paired; pereopod 7 elongate and different from shorter pereopods 5–6, dactyl of pereopod 7 elongate and setose; gnathopods sexually diverse, mittenform in female, enlarged mittenform in male, with thin carpi and expanded propodi twisting inward on death. Telson of ordinary length, entire.

Sexual dimorphism. Gnathopods diverse, large in male, small in female.

Relationship. Paracalliopiidae differ from Exoedicerotidae in the lack of apical spines on rami of uropods 1–2; from Oedicerotidae in the paired eyes, fused urosomites (occasionally present in Oedicerotidae), non-galeate head and odd gnathopods; from Eusiridae-Calliopiidae in the fused urosomites 1–2 and odd gnathopods; from Dexaminidae in the greatly elongate pereopod 7 with elongate setose dactyl and the uncleft telson.

List of genera. Paracalliope Stebbing, 1899: 210; *Indocalliope* Barnard and Karaman, 1982: 182; *Katocalliope* Barnard and Drummond, 1984: 147; *Doowia* Barnard and Drummond, 1987: 117; *Yhi* Barnard and Thomas, 1991: 284. Keys to the genera were given by Barnard and Thomas (1991).

Paracalliope Stebbing

Paracalliope Stebbing, 1899: 210 (type species, *Calliope fluviatilis* Thomson, 1879, original designation). — J.L. Barnard, 1972: 70.

Paroediceropsis Fearn-Wannan, 1968: 50 (type species, *Paroediceropsis raymondi* Fearn-Wannan, 1968, original designation).

Diagnosis. Paracalliopiidae bearing mandibular palp; inner plate of maxilla 1 fully setose medially; oostegites diverse, 2–3 expanded, 4–5 slender; epimera with angular posteroventral corners; peduncle of uropod 3 elongate. Calceoli like eusirid kind of Lincoln and Hurley (1980: 111) with distal and proximal element extending beyond bulla and receptacle; distal element linguiform or arrow-head shaped.

Species.

P. australis (Haswell, 1880, 1882) (= *Paroediceropsis raymondi* Fearn-Wannan, 1968) (Della Valle, 1893 as *Pherusa australis*) (? = *P. fluviatilis* det. of Chilton, 1920), marine, SE Australia [784 + E].

P. fluviatilis (Thomson, 1879) (J.L. Barnard, 1972; Hurley, 1975; Lewis, 1976; Chapman and Lewis, 1976), fresh water, New Zealand [935].

P. karitane J.L. Barnard, 1972 (Hurley, 1975; Lewis, 1976; Chapman and Lewis, 1976), brackish, New Zealand [936X].

P. larai Knott, 1975, fresh water, Tasmania [941].

P. lowryi Barnard and Drummond, herein, south-eastern Australia [784].

P. mapela Myers, 1985, marine, Fiji [576].

P. novaecaledoniae Ruffo and Paiotta, 1972, fresh water, New Caledonia [933].

P. novizealandiae (Dana, 1852, 1853) (= *P. neozelanicus* Thomson and Chilton, 1886; Chilton, 1909; J.L. Barnard, 1972), marine, New Zealand [775].

P. vicinus Barnard and Drummond, herein, brackish-fresh water, Tasmania [783EF].

species inquirenda (= *P. fluviatilis* det. of Chilton, 1921), fresh water, Philippines [982].

Habitat and distribution. New Zealand, Australia, New Caledonia, Philippines, Fiji, weakly marine, mostly estuarine to fresh water.

Key to species of *Paracalliope* (adults)

(*P. larai* is cited twice because of possible misinterpretation of epimera)

1. No rami of uropods 1–3 with more than 1 spine each 2
— At least 4 rami of uropods 1–3 each with 2 or more spines 3
2. Female coxa 1 widened distally, coxa 2 tapering distally, carpal lobe of female gnathopod 2 half as long as propodus ..... *P. novaecaledoniae*
— Female coxa 1 tapering distally, coxa 2 broadened distally, carpal lobe of female gnathopod 2 one fourth as long as propodus ..... *P. mapela*
3. Epimera 2–3 with large tooth (fig. 8nW) 4
— Epimera 2–3 with small tooth (fig. 4E) 6

4. Male gnathopod 1 as small as in female, eyes enlarged (mandibular palp article 3 with 1–3 basofacial setae, outer ramus of uropod 1 with 0–1 spine) ..... *P. lowryi*
— Male gnathopod 1 enlarged, eyes medium (other characters mixed) . 5
5. Mandibular palp article 3 with 0–1 basofacial spine-seta, outer ramus of uropod 1 with 2 spines, epimeron 3 without spines in adult . . *P. larai*
— Mandibular palp article 3 with 3 basofacial spine-setae, outer ramus of uropod 1 with 1 spine, epimeron 3 with 3 spines ..... *P. vicinus*
6. Male eyes small, pereopods 3–6 with dactylar slit 7
— Male eyes large, dactylar slits absent 8
7. Male pereopods 3–4 with setae poorly developed, mandibular palp article 3 with 2 basofacial setae ..... *P. karitane*
— Male pereopods 3–4 with setae large and dense, mandibular palp article 3 lacking basofacial setae ..... *P. australis*
8. Epimera 2–3 with widely sweeping posterior concavity directly leading to protuberant posteroventral tooth ..... *P. larai*
— Epimera 2–3 with narrowly contained posterior concavity from which small sharp posteroventral tooth emerges 9
9. Gland cone small, lateral cephalic lobes weak, female gnathopods with medium carpal lobes ..... *P. novizealandiae*
— Gland cone large, lateral cephalic lobes prominent, female gnathopods with large carpal lobes ..... *P. fluviatilis*

Paracalliope australis (Haswell) comb. nov.

Figures 1–4, 10 (part)

Pherusa australis Haswell, 1880: 103, pl. 7 fig. 1. — 1882: 246.

Paroediceropsis raymondi Fearn-Wannan, 1968: 51–58, figs 12–15.

Material examined. Holotype lost, type locality: Botany Bay [NSW].

Neotype. Botany Bay, Cape Banks, 5 Mar 1985, supralittoral, P. Versteger, AM P.35636 (male "tl" 3.31 mm).

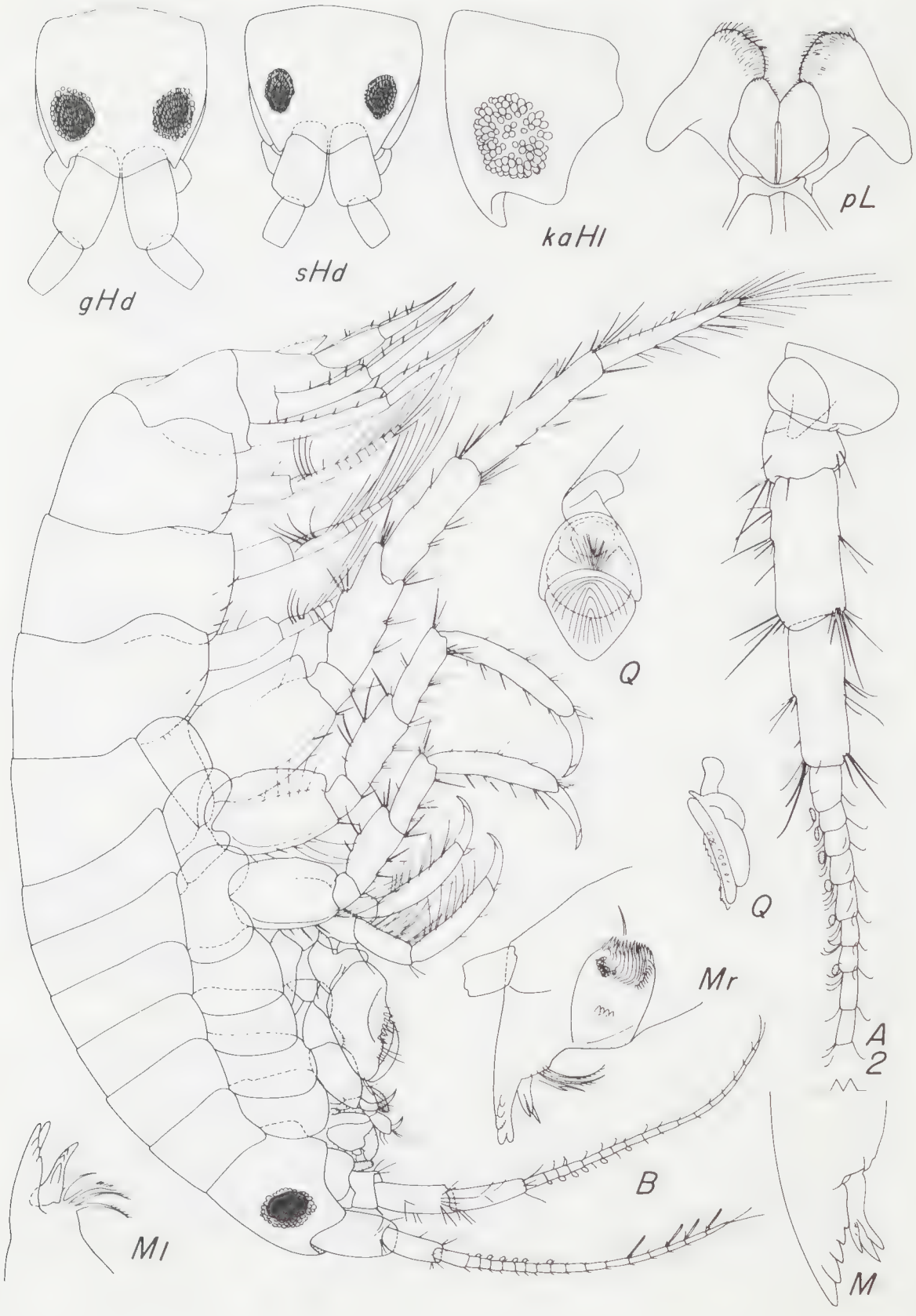
Other type material. Victoria, Gippsland Lakes, Eagle Point, Lake King (37°53′S, 147°41′E), Apr 1957, NMV J157 (1, HOLOTYPE of *Paroediceropis raymondi*), NMV J158 (44, 21 slides, PARATYPES of *Paroediceropis raymondi* of which a few examined as follows, newly designated by letters and sizes: female "a" 3.53 mm, female "b" 2.91 mm, male "c" 3.24 mm, male "d" 3.48 mm, male "e" 3.38 mm.

Other material. Central Bass Strait, 28 km E of Cape Farewell, King Island, Tasmania (39°32.8′S, 144°16′E), 18 m, fine sand, WHOI epibenthic sled, M. Gomon and G.C.B. Poore RV *Sarda*, 1 Nov 1980 (stn BSS-S 107), NMV J13088 (1).

New South Wales. Neotype locality, AM P35636 (male "tk" 3.63 mm, male "tm" 2.97 mm, female "tn" 2.60 mm, juvenile "to" 2.48 mm, verifying taxonomy; Twofold Bay, Shadrack Creek, *Zostera*, mud, I. Vander Velde, AM P35637 (5); Twofold Bay, Fisheries Creek, 19 Sep 1984, *Ruppia* bed, mud, AM P35638 (11); Dee Why Lagoon (31°31′S, 149°54′E, 0.75 m, 29 Nov 1988, muddy sand and algae, A. Murray and A.R. Jones, AM P39142 (7); Merimbula (36°54′S, 149°53′E), sand, hand net, M.M. Drummond, 1 Dec 1978, NMV J6904 (juvenile voucher "jb", 1.78 mm); NMV J6903 (juvenile voucher "ja", 1.13 mm). Merimbula, Back Lake, M.M. Drummond, 1 Dec 1975, NMV J13090 (many); Lake Illawarra, entrance, NMV J22287 (3).

Tasmania. Nierinna Creek, near Margate (43°02′S, 147°13′E), T. Walker, NMV J13093 (many), NMV J6912 (female voucher "m", 3.64 mm), NMV J6911 (female voucher "s", 2.89 mm), NMV J6909 (female voucher "p", 3.30 mm, illustrated), NMV J6914 (juvenile voucher "t", 1.86 mm), NMV J6907 (male voucher "h", 2.70 mm), NMV J6915 (juvenile voucher "j", 1.60 mm), NMV J6908 (male voucher "g", 3.71 mm), NMV J6913 (female voucher "u", 2.60 mm), NMV J6910 (female voucher "w", 2.68 mm); Swan River, site 6, D. Hoggins, Tasmanian Fisheries Development Authority, Jul 1978, NMV J6905 (juvenile voucher "ka", 3.23 mm, illustrated), NMV J6906 (female voucher "kb", 2.66 mm), NMV J13092 (1); Wandle River, on road from Wynyard to Waratah, P. Suter, 26 Aug 1973, NMV J6954 (2); Swanport, estuary mouth, Tasmanian Fisheries Development Authority, NMV J13087 (9).

Victoria. Gippsland Lakes, Lake Victoria, near Red Bluff (38°03.5′S, 147°31′E), G.C.B. Poore et al., SCUBA, MSL preliminary survey, stn G609-5, 15 Nov 1976, NMV J13084 (1); Lake King, near Paynesville (37°55.5′S, 147°43′E), stn G609-29, NMV J6997 (9); Lake King, near Point Jones (37°55′S, 147°45′E), stn G609-28, NMV J6800 (male voucher "i" 3.86 mm), NMV J6902 (female, voucher "k", 3.51 mm), NMV J13085 (many); Lake King, East of Point Scott, Raymond Island (37°54′S, 147°49′E), stn G609-25, NMV J13086 (1); Lake King, near Kelly Head (37°54′S,


gHd
sHd
kaHl
pL
Q
Q
Mr
A2
B
Ml
M

147°55′E), stn G609-41, NMV J13083 (1), NMV J13079 (1); Lake King, near Mosquito Point (37°53.5′S, 147°52′E), stn G609-33, NMV J13081 (1), NMV J6998 (1); Lake King, N of Kelly Head (37°53.5′S, 147°55′E), stn G609-39, NMV J13078 (11); Lake King, near Eagle Point (37°53′S, 147°44′E), stn G609-14, NMV J13077 (2); Lake King, N of Eagle Point (37°52′S, 147°44′E), stn G609-16, NMV J13082 (1); Lake King, near mouth of Tambo River (37°51.5′S, 147°48′E), stn G609-20, NMV J13080 (1); Lake King, NMV J6799 (male voucher "f", 4.55 mm); Altona salt ponds, G. Davey, NMV J6901 (male voucher "ha", 3.29 mm); Merri River, J.D. Kudenov, NMV J6953 (9).

Description of male neotype "tl" 3.31 mm. Rostrum small, lateral cephalic lobe adze-shaped, sinus receiving antenna 2 deep, eyes small (artificially shrunken), widely separate. Antenna 1 scarcely shorter than antenna 2, flagellum with 14 articles, calceoli absent; one aesthetasc each on articles 9, 11, 12, 13, and rudimentary on 14. Gland cone of antenna 2 very prominent, almost reaching apex of article 3 (in lateral view), flagellum with 10 articles, one calceolus each on articles 3, 4.

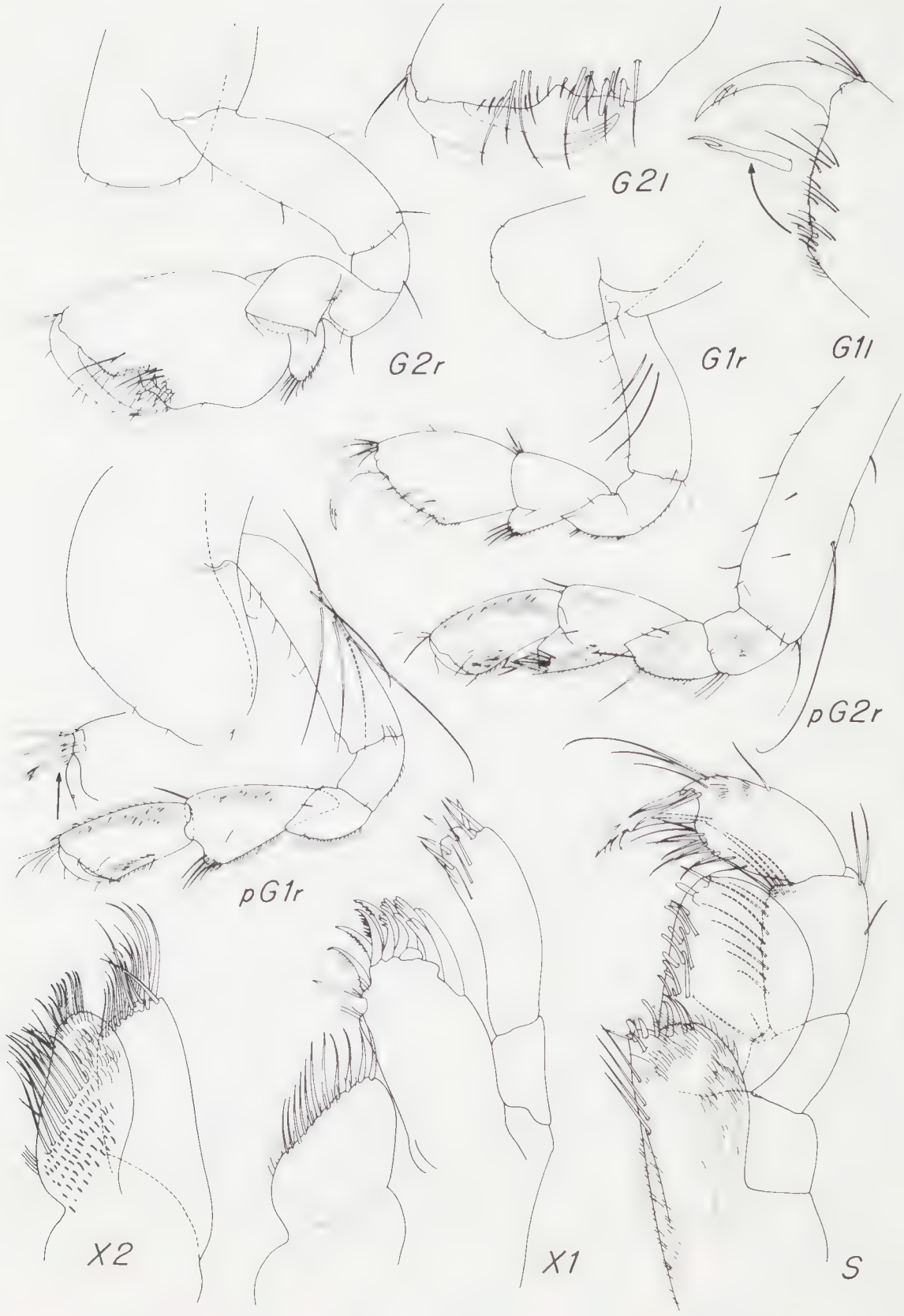
Epistome flat anteriorly, upper lip articulate and rounded-truncate below, anterior pubescence poorly developed. Mandibles of basic gammaridean plan, incisors toothed, right and left laciniae mobiles toothed, right and left rakers 3 and 4 respectively, first raker on left bifid (possibly 2 rakers fused?); molar triturative, bearing apical seta; palpar hump small, articles 1–2 naked, article 3 especially pubescent, formula of spines = 3D, 5E, with 3 of E setae simple, others penicillate, basofacial setae absent. Inner lobes of lower lip well developed and fleshy. Inner plate of maxilla 1 almost fully setose medially, outer plate with 11 diverse spines, palp 2-articulate, spinose apically, right and left palps alike. Plates of maxilla 2 subequal in size, inner with facial row of setae. Inner and outer plates of maxilliped weakly spinose, palp short, stout, dactyl unguiform, with about 2 accessory setules.

Coxae 1–7 short, almost glabrous, almost of even depth except coxa 7 shortened, coxa 1 scarcely expanded in middle, coxa 4 weakly excavate posteriorly and weakly lobate posteroventrally; coxae 2–6 each with narrow sac-like gill with pediculate base. Medium sized lobe on carpus of gnathopod 1 pointing slightly distad, propodus ovately expanded, palm about as long as posterior margin of propodus, well defined by change in slope, palm with organized clusters of armaments, dactyl fitting palm, with several subapical setules. Carpus of gnathopod 2 forming complex of 2 basal swellings side by side and thin posterior lobe curving distad, propodus turning inward on death, ovatorectangular, palm oblique, deeply and raggedly excavate, with 2 lateral and 4 medial facial spines proximal to ragged margin, dactyl slender, fitting palm.

Article 4 of pereopods 3–6 slender, posterior margins of articles 4–6 of pereopods 3–4 with moderately long setae in fascicles, generally fascicle formula number on articles 4–6 = 4-6-5, each fascicle with 1–4 setae (see illustrations). Only one member each of pereopods 3 and 6 with conspicuous slit on dactyls, all with setules. Pereopods 5–6 of ordinary amphipod dimensions, 6 slightly larger than 5, article 2 ovate, poorly produced posteroventrally, almost smooth, each with midfacial ridge, that on pereopod 5 naked, that on pereopod 6 setose. Pereopod 7 enlarged, article 2 broad and subquadrate, weakly and subsharply produced posteroventrally, dactyl over 110% as long as article 6, with about 6 anterior fascicles of setae, numerous single posterior setae in tandem and 10+ apical setae.

Pleopods ordinary, peduncle elongate, rami elongate, subequal and multiarticulate. No pleonal epimeron dominant, each with tiny posteroventral tooth and weakly to strongly convex posterior margin (epimeron 2 weakest), epimeron 1 with 1–2 (L + R) facial spines and 3 anteroventral setae, epimeron 2 with 3–4 (R + L) ventral but submarginal spines in tandem horizontally, epimeron 3 with 1 submarginal spine and 1 setule in tandem horizontally near anteroventral edge. Uropods 1–2 extending subequally, uropod 3 slightly shorter, dorsolateral margin of peduncle on uropod 1 with 7 spines, and discernible apical gap, medial with one apical spine, outer ramus scarcely shorter than inner, outer with 1 dorsal spine, inner with 1. Peduncle of uropod 2 with 2 dorsolateral spines, medial with one apical, outer ramus shorter than inner, outer with 2 dorsal spines, inner with 2. Peduncle of uropod 3 elongate, with 1 dorsomedial spine and basal setule, outer ramus scarcely shorter than inner, as long as ped-

Figure 1. *Paracalliope australis*, unattributed figures = male "m" holotype, 3.64 mm; g = male "g" 3.71 mm; ka = male "ka" 3.23 mm; p = female "p" 3.30 mm; s = female "s" 2.89 mm.


G2r
G2l
G1r
G1l
pG2r
pG1r
X2
X1
S

uncle, with 1 dorsal spine, inner with 1 dorsal spine, each ramus with subapical setule. Telson linguiform, entire, with 2 pairs of dorsolateral setules in middle and one apicolateral setule on one side only.

Description of adult male "m". Rostrum small, lateral cephalic lobe adze-shaped, sinus receiving antenna 2 deep, eyes of medium size, widely separate. Antenna 1 scarcely shorter than antenna 2, flagellum with 16 articles, one calceolus each on articles 1, 2, 3, 4, 5, 7; one aesthetasc each on articles 11, 13, 14, 15 and rudimentary on 16. Gland cone of antenna 2 very prominent, almost reaching apex of article 3 (in lateral view), flagellum with 17 articles, one calceolus each on articles 1, 2, 3, 4, 5, 7. Epistome flat anteriorly, upper lip articulate and rounded-truncate below, anterior pubescence poorly developed. Mandibles of basic gammaridean plan, incisors toothed, right and left laciniae mobiles toothed, right and left rakers 3 and 4 respectively, first raker on right bifid (possibly 2 rakers fused?); molar triturative, bearing apical seta; palpar hump small, articles 1–2 naked, article 3 especially pubescent, formula of spines = 4D, 3E, with 2 of E setae simple, others penicillate, basofacial setae absent. Inner lobes of lower lip well developed and fleshy. Inner plate of maxilla 1 almost fully setose medially, outer plate with 11 diverse spines, palp 2-articulate, spinose apically, right and left palps alike. Plates of maxilla 2 subequal in size, inner with facial row of setae. Inner and outer plates of maxilliped weakly spinose, palp short, stout, dactyl unguiform, with about 4 accessory setules.

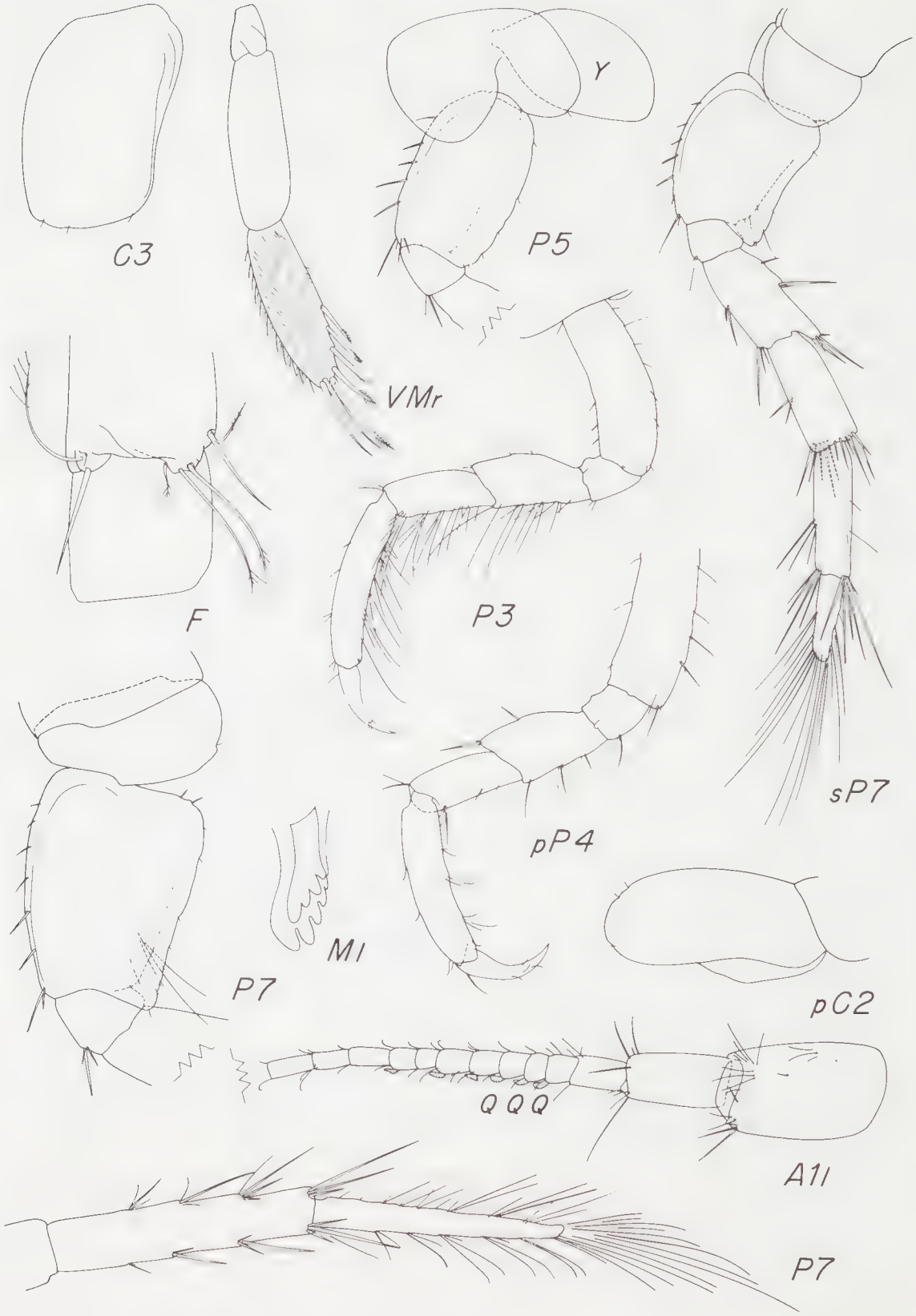
Coxae 1–7 short, almost glabrous, almost of even depth except coxa 7 shortened, coxa 1 scarcely expanded in middle, coxa 4 weakly excavate posteriorly and weakly lobate posteroventrally; coxae 2–6 each with narrow sac-like gill with pediculate base. Medium sized lobe on carpus of gnathopod 1 pointing slightly distad, propodus ovately expanded, palm about as long as posterior margin of propodus, well defined by change in slope, palm with organized clusters of armaments, dactyl fitting palm, with several subapical setules. Carpus of gnathopod 2 forming complex of 2 basal swellings side by side and thin posterior lobe curving distad, propodus turning inward on death, ovatorectangular, palm oblique, deeply and raggedly excavate, with 3 lateral and 4 medial facial spines proximal to ragged margin, dactyl slender, fitting palm.

Article 4 of pereopods 3–6 slender, posterior margins of articles 4–6 of pereopods 3–4 with long setae in fascicles, generally fascicle formula number on articles 4–6 = 4-5-7, each fascicle with 1–6 setae (see illustrations). Dactyls with conspicuous slit and setules. Pereopods 5–6 of ordinary amphipod dimensions, 6 slightly larger than 5, article 2 ovate, poorly produced posteroventrally, almost smooth, each with midfacial ridge, that on pereopod 5 naked, that on pereopod 6 setose. Pereopod 7 enlarged, article 2 broad and subquadrate, weakly and subsharply produced posteroventrally, dactyl over 90% as long as article 6, with about 5 anterior fascicles of setae, numerous single posterior setae in tandem and 7+ apical setae.

Pleopods ordinary, peduncle elongate, rami elongate, subequal and multiarticulate. No pleonal epimeron dominant, each with tiny posteroventral tooth and weakly to strongly convex posterior margin (epimeron 2 weakest), epimeron 1 with 2 facial spines and 5 anteroventral setae, epimeron 2 with 4 ventral but submarginal spines in tandem horizontally and one strongly facial smaller spines, epimeron 3 with 2 submarginal spines in tandem horizontally near anteroventral edge. Uropods 1–2 extending subequally, uropod 3 slightly failing same extension, dorsolateral margin of peduncle on uropod 1 with 9 spines, medial with one apical spine, outer ramus scarcely shorter than inner, outer with 2 dorsal spines, inner with 3. Peduncle of uropod 2 with 6 dorsolateral spines, medial with one apical, outer ramus shorter than inner, outer with 5 dorsal spines, inner with 3. Peduncle of uropod 3 elongate, with 2 dorsomedial spines and basal setule, outer ramus scarcely shorter than inner, as long as peduncle, with 2 dorsal spines, inner with 2 dorsal spines, each ramus with subapical setule. Telson linguiform, entire, with 2 pairs of dorsolateral setules in middle and one apicolateral setule on each side.

Female paratype "m" 2.60 mm. Eyes of medium size. Flagellum of antenna 1 with 6 articles, article 5 with one aesthetasc. Flagellum of antenna 2 with 10 articles. Gnathopods, see illustrations. Article 7 of pereopod 7 about 90%

Figure 2. *Paracalliope australis*, unattributed figures = male "m" holotype, 3.64 mm; p = female "p" 3.30 mm.


C3
Y
P5
VMr
F
P3
sP7
pP4
M1
P7
pC2
QQQ
A11
P7

as long as article 6, with 3 anterior setae, 2 pairs of posterior setae and 10 apical setae. Epimeron 1 with 1 facial spine and 2 anteroventral setules; epimeron 2 with 2 facial spines; epimeron 3 lacking spines. Spine formulas on peduncle, outer ramus and inner ramus of uropods: uropod 1 = 1-1-1-1-1(slight gap)-1, 1, 1; uropod 2 = 1-1, 2, 2; uropod 3 = 1, 1, 1.

Female "p". Pereopod 7 broken. Like male but antennae lacking calceoli, flagellum of antenna 1 with 11 articles, one aesthetasc each on articles 6, 8, 9, 10, (11 rudimentary); flagellum of antenna 2 with 13 articles. Coxae 1–4 longer than in male, coxa 1 somewhat nasiform and posteroventrally extended, coxae 2–3 narrow, coxa 4 with strongly beveled ventral margin toward posterior side. Oostegites 2–3 broad, 4–5 narrow and setose. Gnathopods feeble, equally slender and almost of same length, carpi as long as propodi, gnathopod 1 much more slender and slightly more elongate than in male, carpus with large lobe pointing distad, propodus subrectangular but weakly expanding apically, palm subtransverse; carpus of gnathopod 2 with weak posterior lobe, palm oblique. Pereopods 3–4 poorly setose compared with male (see illustrations). See female "s" for pereopod 7 distinction below. Differences of epimera probably varietal (see illustration), one spine of epimeron 1 more ventrad, one of epimeron 2 poorly developed, one of epimeron 3 missing and other weak. Some uropods better spined than in male; outer and inner rami respectively with spines as follows: uropod 1 = 3 and 3, uropod 2 = 3 and 3, uropod 3 = 2 and 2.

Female "s". Pereopod 7 showing major female differences from male, pereopod 7 shorter and dactyl much shorter than article 6, anterior and posterior setae fewer but apical setae dense. Flagellum of antenna 1 with 9 articles, one aesthetasc each on articles 6, 7, 8, 9 (rudimentary).

Young male "t". Calceoli absent, flagellum of antenna 1 with 8 articles, one aesthetasc each on articles 5, 6, 7; flagellum of antenna 2 with 7 articles. Epimeron 1 with one facial spine and one anteroventral seta, epimeron 2 with one facial spine, epimeron 3 lacking spines. Spine formula on outer and inner rami of uropod 1 = 0-1, uropod 2 = 1-1, uropod 3 = 1-1, peduncle of uropod 3 with 3 dorsal spines! (2 medial, 1 lateral).

Juvenile "j". Flagellum of antenna 1 with 6 or 7 articles, aesthetascs present on articles 4-5 or 5-6-7; flagellum of antenna 2 with 7 articles. Slit on dactyls of pereopods 3–6 dim. Epimeron 1 with one facial spine and 2 anteroventral setae, epimeron 2 with 2 facial spines, epimeron 3 without spines. Spine formulas on uropods, peduncle of uropod 1 = 3, both rami = — 0; peduncle of uropod 2 = 1, each ramus with 1; outer ramus of uropod 3 = 0, inner = 1.

Juvenile "ja", smallest available. Flagella of antennae 1–2 with 5 and 6 articles respectively; length ratio of peduncular articles = 5:3:3. Posterior margin of article 6 on pereopods 3–4 with only 1 conjoint pair of setae, slits absent. Epimeron 1 with one tiny facial setae, no other armaments, spine formula of epimeron 2 = 1, of epimeron 3 = 0. Spine formulas of uropod 1 =3 (gapped)-0-0, of uropod 2 = 1-0-1, of uropod 3 = 0-0-0. Article 2 of pereopod 7 with one posterodistal seta, article 7 of long form, with 3 main apical setae, 2 short posterodistal setae, and 3 other marginal setae.

Variables of males "c, d, e, f, g, h." Sizes between 2.70 and 4.55 mm. Flagellum of antenna 1 with as many as 18 articles, calceolus formulas = 2, 3, 4, 6 or 2, 3, 4, 5, 7 or 2, 3, 4, 5, 6, 7 or 2, 3, 4, 6, 8. Aesthetascs on 10 only on 9-11-13-15-16-17-18, or 10-12-13-14, or 11-13-15-16-17-18. Antenna 2 flagellum with up to 20 articles, calceoli formulae either 1, 2, 3, 4, 5, 6, 8 or 2, 3, 4, 5, 7, 9 or 2, 3, 4, 6, 8 or 3, 4, 6. Eyes enlarged or not. Articles 5 and 6 of pereopods 3–4 with up to 6 or 7 setal fascicles. Epimeron 1 with 1–2 facial spines and 2, 3, 4, 5 or 6 anteroventral setae; epimeron 2 with 3 or 5 or 4 and 1 rudimentary facial spines; epimeron 3 with 1, 2 or 3 facial spines. Teeth of epimera occasionally obsolescent or blunted. Spine formulas on uropods, peduncle of uropod 1 = 5, 6, 9, 10; outer ramus = 1, 2; inner ramus = 2, 3; uropod 2 peduncle = 4, 5, 6; outer ramus = 2, 3, 4, 5; inner ramus = 2, 3, 4; peduncle of uropod 3 = 2, 3; outer ramus = 2, 3; inner ramus = 2, 3.

Variables of females "a, b, k, s, u, w". Sizes between 2.60 and 3.53 mm. Flagellum of antenna 1 with up to 11 articles, of antenna 2 up

Figure 3. *Paracalliope australis*, unattributed figures = male "m" holotype, 3.64 mm; p = female "p" 3.30 mm; s = female "s" 2.89 mm.

to 12 articles; aesthetascs on flagellum of antenna 1 = 6, 7, 8, 9 or 7, 9, 10, 11. Epimeron 1 with 1–2 facial spines and 3, 4, 5, 8 anteroventral setae; epimeron 2 with 2, 3, 5, 6 facial spines; epimeron 3 with 0, 1, 2, 3 facial spines. Spine formulas on uropods, peduncle of uropod 1 = 5, 8, 10, 11; outer ramus = 1, 2; inner ramus = 2, 3; uropod 2 peduncle = 2, 3, 4, 6; outer ramus = 2, 3, 4; inner ramus = 2, 3, 4; peduncle of uropod 3 = 2, 3; outer ramus = 1, 2; inner ramus = 1, 2, 3. Article 7 of pereopod 7 aberrant in female "a" (with 8 eggs), as long as in male.

Aberrant male "ha", 3.22 mm. Aberrant because of absence of spine on outer ramus of uropod 1 and slight gap present between ultimate and penultimate spines on peduncle of uropod 1, otherwise *P. australis* characters typical: epimera, pereopods 3–4, dactylar slits, head shape, mandibular palp article 3 and eyes.

Aberrant male "ka" and female "kb." Eyes enlarged (illustrated), ommatidia slightly dispersed, pigment weak; thus intermediate in eye size between ordinary specimens of *P. australis* and specimens of *P. lowryi*; specimens otherwise with scarcely any excessive gap in spines on uropod 1, setae of epimeron 1 weak.

Male of NMV J13088. Identification doubtful because mandibular palps and pereopods 3-4 missing, third uropods aberrant; provisionally identified as *P. australis* because of small teeth of epimera but gnathopod 1 scarcely enlarged (thus like *P. lowryi*); well developed spination of uropods like *P. lowryi*; but epimeron 1 with anteroventral setules unlike *P. lowryi*.

General variables. Specimens of this species often preserve poorly; various appendages fall off or are broken apically, especially pereopod 7 and uropod 3. The internal contents of the head often preserve poorly so that the tissue shrinks and the eyes fall ventrally and occasionally break up. This unfortunately happens also in the companion species *P. lowryi* so that the excellent distinction in eye size between the two species is often obscured by observational anomalies.

The usefulness of analyzing dactylar slits on pereopods 3–6 is very low because so many specimens of *P. australis* that should have the slits well apparent seem to be either poorly preserved or so near their moment of ecdysis that the slits are so dim as to be useless for identification.

There is considerable variation in the size of posterodorsal setules-spines on article 2 of pereopod 7.

The excessive gap between ultimate and penultimate spines on the peduncle of uropod 1 is about 95% accurate in separating *P. lowryi* from *P. australis* but a few specimens of *P. australis* have a slightly increased gap so that the character is not wholly reliable. In the material at hand, one can state for certainty that lack of the excessive gap is wholly characteristic of *P. australis*.

Relationship. This species is very close to the three known species of *Paracalliope* from New Zealand (J.L. Barnard, 1972) but differs from *P. fluviatilis, P. karitane* and *P. novizealandiae* in the presence of long setae on articles 5–6 of male pereopods 3–4. Most specimens of *Paracalliope australis* also differ from *P. fluviatilis* and *P. novizealandiae* in the presence of the conspicuous slit in the dactyls of pereopods 3–6, but this slit is occasionally absent in *P. australis*. The Australian species is therefore very similar to *P. karitane* but differs from that species in the lack of basolateral setae on article 3 of the mandibular palp. It also differs from *P. karitane* in the less tumid propodi on male and female gnathopods, smaller teeth on epimera 2–3, and the small carpal lobes of female gnathopod 1.

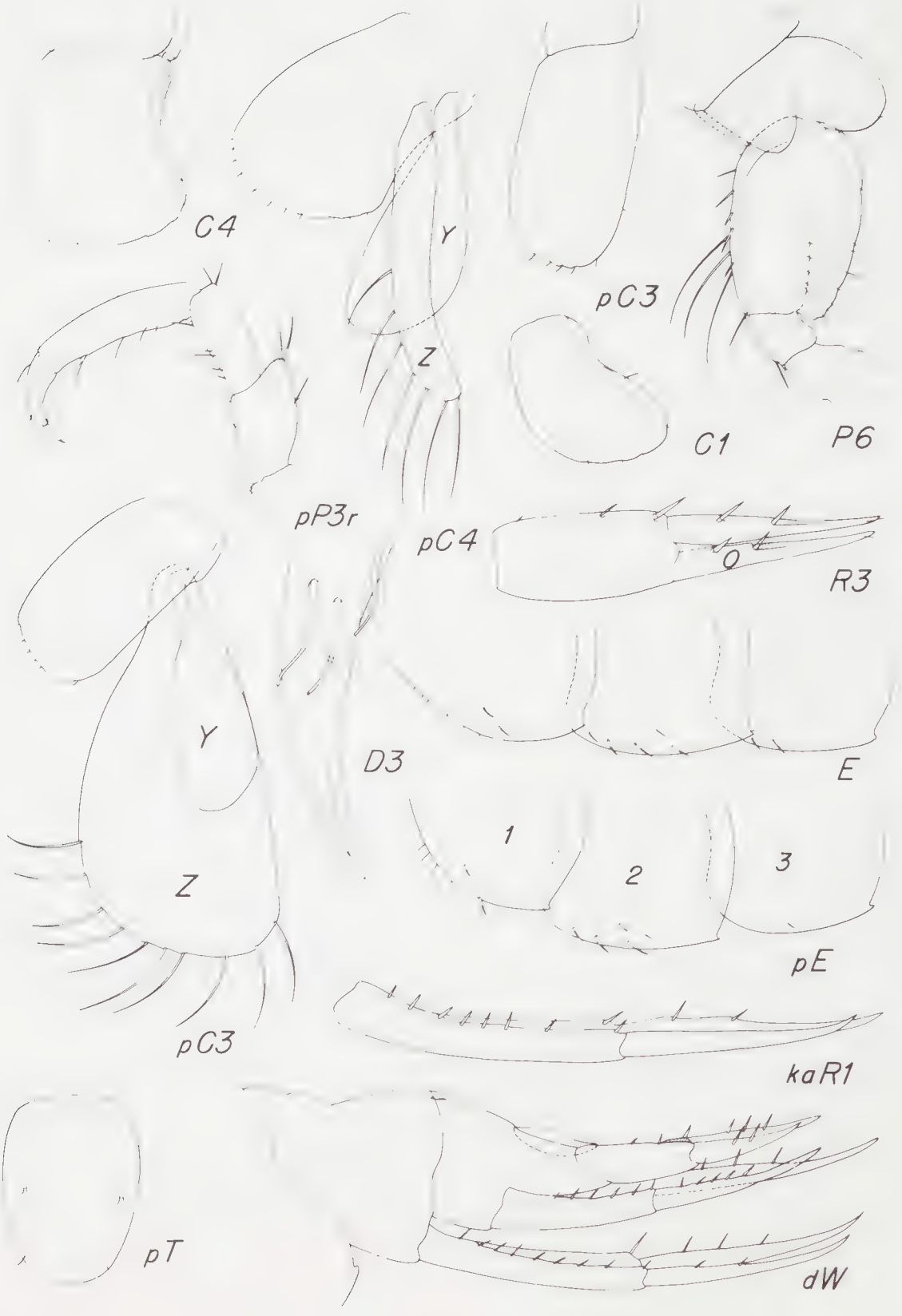
Paracalliope australis differs further from *P. novizealandiae* in the lack of AB setae on the mandibular palp, the presence of more spines on the rami of uropods 1–3, the larger carpal lobe of female gnathopod 2, the smaller carpal lobe of female gnathopod 1, the presence of more spines on epimera 1–2 and the less tumid propodi of male gnathopods 1–2.

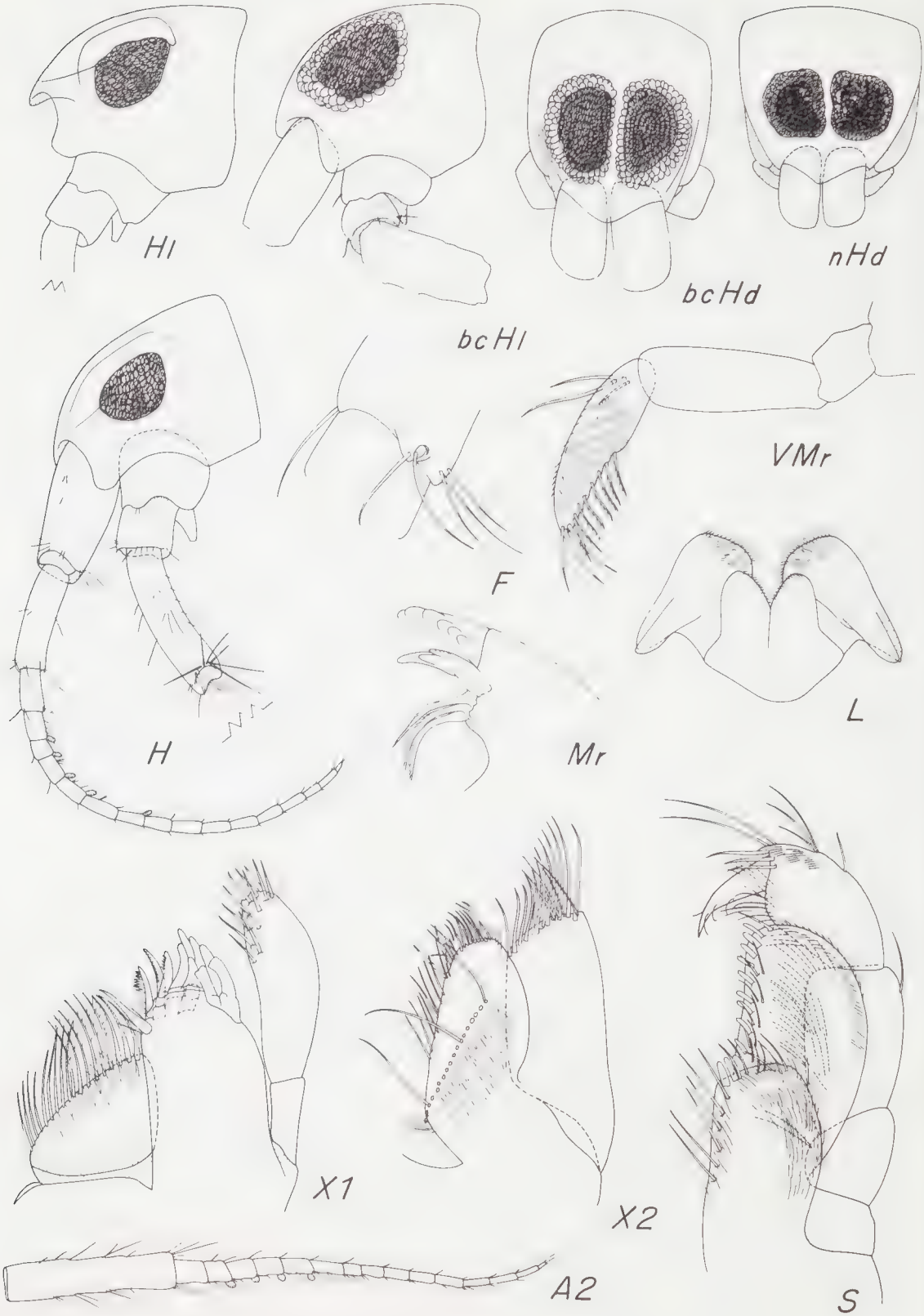
Paracalliope australis further differs from *P. fluviatilis* in the smaller carpal lobe of female gnathopod 1, the more slender female gnathopod 1, the more beveled female coxa 1, and the shorter palm on male gnathopod 1.

Although size of eyes, shape of teeth on epimera, and usual lack of excessive gap between spines on uropod 1 are all characteristics of 95% of the specimens of *P. australis* the best characters distinguishing this species from *P. lowryi* is the presence of setules, setae or weak spines on the anteroventral margin (not face) of epimeron 1 and the small teeth of epimera 2–3. This situ-

---

Figure 4. *Paracalliope australis*, unattributed figures = male "m" holotype, 3.64 mm; d = male "d" 3.48 mm; ka = male "ka" 3.23 mm; p = female "p" 3.30 mm.


C4
Y
Z
pC3
C1
P6
pP3r
pC4
O
R3
Y
D3
E
1
2
3
Z
pE
pC3
kaR1
pT
dW


Hl
nHd
bcHd
bcHl
VMr
F
L
H
Mr
X1
X2
A2
S

ation makes identification rather tedious as these plates are difficult to see in undissected individuals.

Distribution. New South Wales, Victoria, and Tasmania, shoreline tidepools of open sea, 0–18 m, inlets, estuaries and Gippsland Lakes.

Paracalliope lowryi sp. nov.

Figures 5–8

Material. Holotype. Victoria. Gellibrand River mouth (38°35′S, 143°20′E), hand, J.D Kudenov, 1976, NMV J6916 (male "x", 5.07 mm, illustrated).

Other material. New South Wales. Merimbula, near entrance to inlet (36°54′S, 149°53′E), sand, M.M. Drummond, 10 Feb 1972, NMV J6927 (female voucher "cd", 2.49 mm, illustrated), NMV J6928 (male voucher "bc", 3.00 mm, illustrated). Merimbula, J.H. Day, *et al.*, 9 May 1975, NMV J6929 (aberrant male voucher "mb", 3.49 mm, illustrated), NMV J6930 (female, voucher "ma", 2.46 mm). Bells Point (34°18′S, 150°56′E), sand, D. Dexter, 16 Feb 1981, NMV J6922 (male voucher "aa", 2.26 mm), NMV J6921 (aberrant male voucher "ab", 2.03 mm illustrated), NMV J6921 (12). Black Dolphin Beach, Merimbula, M.M. Drummond, 1 Dec 1978, NMV J6985 (1). Merimbula, weed on sand in channel, M.M. Drummond, 6 Feb 1972, NMV J6991 (2). Narageen Lagoon, D.M. Dexter, 24 Sep 1980, NMV J6983 (4), NMV J6926 (female voucher "z", 2.24 mm), NMV J6924 (female voucher "v", 2.10 mm), NMV J6925 (female, voucher "l", 2.18 mm), NMV J6923 (male voucher "y", 2.55 mm). Dee Why Lagoon (31°31′S, 149°54′E), 0.75 m, 29 Nov 1988, 0.75 m, A. Murray and A.R. Jones, muddy sand and algae, AM P39144.

Tasmania. Kellevie, under main bridge (42°47′S, 147°49′E), B. Knott, 26 Sep 1972, NMV J6961 (many). Derwent River Estuary, A. Schaap, AM P665 (male 665).

Victoria. Gellibrand River mouth (38°35′S, 143°20′E), hand, J. Kudenov, 1976, NMV J6917 (male voucher "o", 3.83 mm, illustrated), NMV J6919 (female voucher "n", 3.48 mm, illustrated), NMV J6918 (male voucher "q", 3.72 mm), NMV J6920 (female, voucher "p", 3.26 mm). Gippsland Lakes, Reeve Channel (38°14.0′S, 147°32.7′E), 5 m, sand, Smith-McIntyre grab, G.C.B. Poore (Marine Studies Group), stn GRES 3060, NMV J6992 (2), NMV J6995 (1). Bancroft Bay (38°11.7′S, 147°33.1′E), 6 m, mud, stn GRES 3059, NMV J6993 (1). Lake Victoria, near Loch Sport (38°03′S, 147°35.5′E), stn G609-8, NMV J13075 (1). Lake Victoria, N of Red Bluff (38°02.5′S, 147°31′E), stn G609-7, NMV J7000 (2). off Pt Turner, Lake Victoria (38°02.0′S, 147°37.0′E), 8 m, mud, stn GRES 3057, NMV J6994 (1). Lake King, S of Paynesville (37°57′S, 147°45′E), stn G609-31, NMV J13076 (1); stn G609-30, NMV J6999 (1). Lake King, near Point Jones (37°55′S, 147°45′E), stn G609-28, NMV J6986 (1). Lake King, East of Point Scott, Raymond Island (37°54′S, 147°49′E), stn G609-25, NMV J13074 (6). Gippsland Lakes, J.D. Kudenov, 1975, NMV J6990 (1). Gippsland Lakes, J.D. Kudenov, 7 Aug 1975, NMV J6987 (2). Glenelg River, J.D. Kudenov, NMV J13089 (4), NMV J6988 (1).

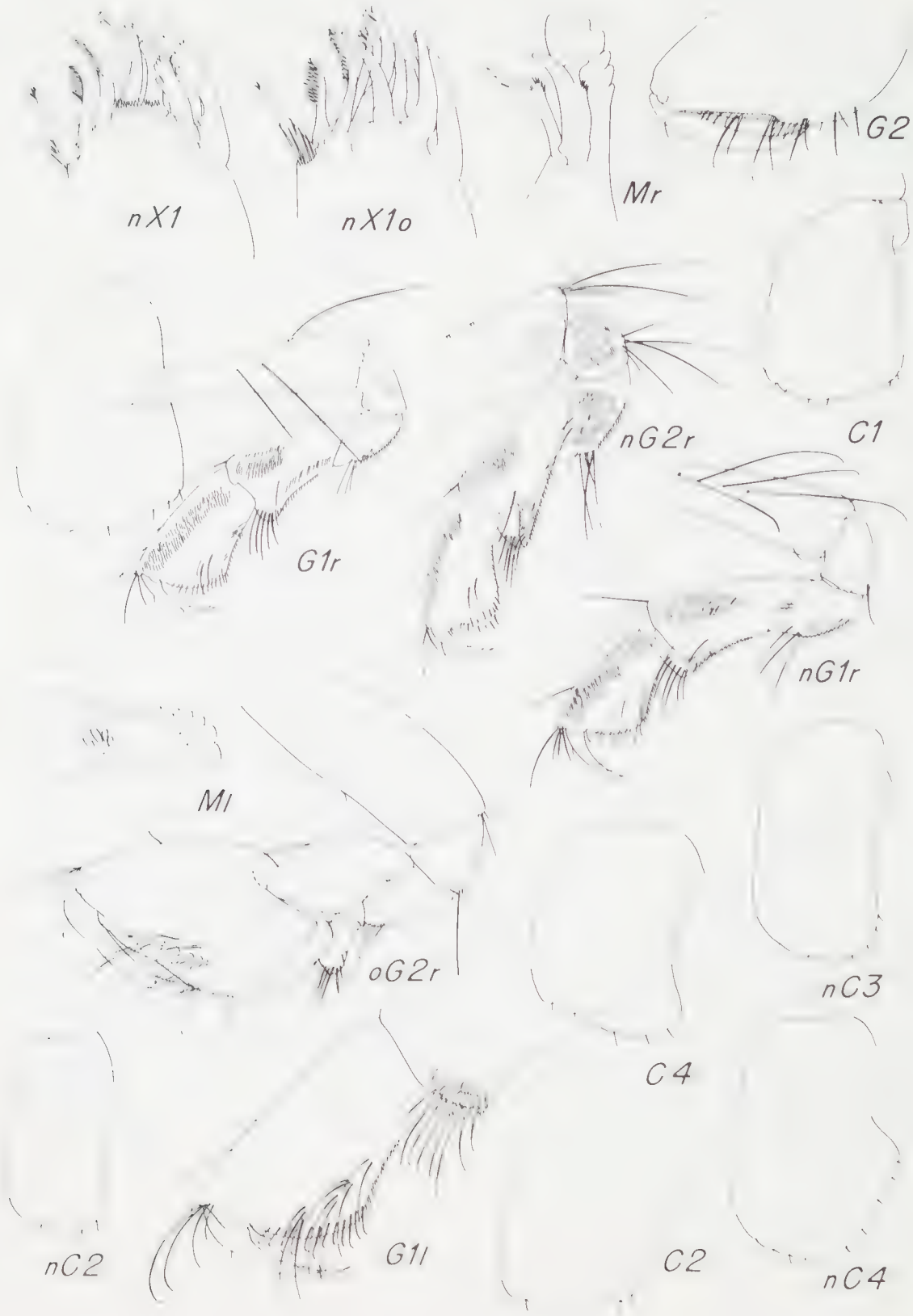
Queensland. Mouth of Jacksons Creek, left bank, site J2/L, sample 287, 19 Jul 1973, T.S. Campbell, QM W4498 (specimen "jd"); midstream, QM W4504 (male "jc" like aberrant male "ab". Serpentine Branch, left bank, 2.1 km from mouth, site 2B/L, sample 26, 27 Jul 1972, T.S. Campbell, (QM W4078 (specimen "sb").

Description. Holotype male "x". Rostrum small, lateral cephalic lobe mammilliform, sinus receiving antenna 2 deep, eyes huge, almost touching medially. Antenna 1 scarcely shorter than antenna 2, flagellum with 15 articles, one calceolus each on articles 1, 2, 3, 4, 6; one aesthetasc each on articles 5, 7, 9, 11, 13, 14 and rudimentary on 15. Gland cone of antenna 2 moderately prominent, flagellum with 15 articles, one calceolus each on articles 2, 3, 4, 5. Calceoli like *P. australis* but distal element more rounded and less attenuate apically.

Epistome flat anteriorly, upper lip articulate and rounded-truncate below, with long stiff anterior pubescence. Mandibles of basic gammaridean plan, incisors toothed, right and left laciniae mobiles toothed, right and left rakers 3 and 4 respectively, first raker on right weakly bifid and more strongly feathered than in *P. australis*; molar triturative, bearing apical seta; palpar hump small, articles 1–2 naked, article 3 especially pubescent, formula of spines = 8D, 3E, E setae simple, others serrate or pinnate or penicillate, basofacial setae 1–2. Inner lobes of lower lip well developed, slightly fleshy. Inner plate of maxilla 1 almost fully setose medially, outer plate with 11 diverse spines, palp 2-articulate, spinose apically, right and left palps alike. Plates of maxilla 2 subequal in size, inner with facial row of setae. Inner and outer plates of maxilliped weakly spinose, palp short, stout, dactyl unguiform, with about 4 accessory setules.

Coxae 1–7 short, almost glabrous, almost of even depth except coxa 7 shortened, coxa 1

Figure 5. *Paracalliope lowryi*, new species, unattributed figures = male "x", holotype, 5.07 mm; bc = male "bc" 3.00 mm; n = female "n" 3.48 mm.


nX1
nX1o
Mr
G2
nG2r
C1
G1r
nG1r
Ml
oG2r
nC3
C4
nC2
G1l
C2
nC4

scarcely expanded in middle, coxa 4 weakly excavate posteriorly and weakly lobate posteroventrally; coxae 2-6 each with narrow sac-like gill with pediculate base. Gnathopod 1 of small size as in female, medium sized lobe on carpus apically situated and pointing slightly distad, propodus expanding apicad, palm shorter than posterior margin of propodus, well defined by change in slope, palm with organized clusters of armaments, dactyl fitting palm, with several subapical setules. Gnathopod 2 enlarged, carpus forming complex of 2 basal swellings side by side and thin posterior lobe curving distad, propodus turning inward on death, ovatorectangular, palm oblique, poorly excavate, with 3 lateral and 5 medial facial spines, dactyl slender, fitting palm.

Article 4 of pereopods 3–6 slender, posterior margins of articles 4–6 of pereopods 3–4 poorly armed, setae short, sparse, in about 3 groups. Dactyls lacking slit, with conspicuous setules. Pereopods 5–6 of ordinary amphipod dimensions, 6 slightly larger than 5, article 2 ovate, poorly produced posteroventrally, with many posterior setules, each with weakly setose midfacial ridge. Pereopod 7 enlarged, article 2 broad and subquadrate, weakly and subsharply produced posteroventrally, dactyl [in males unknown, broken on all specimens].

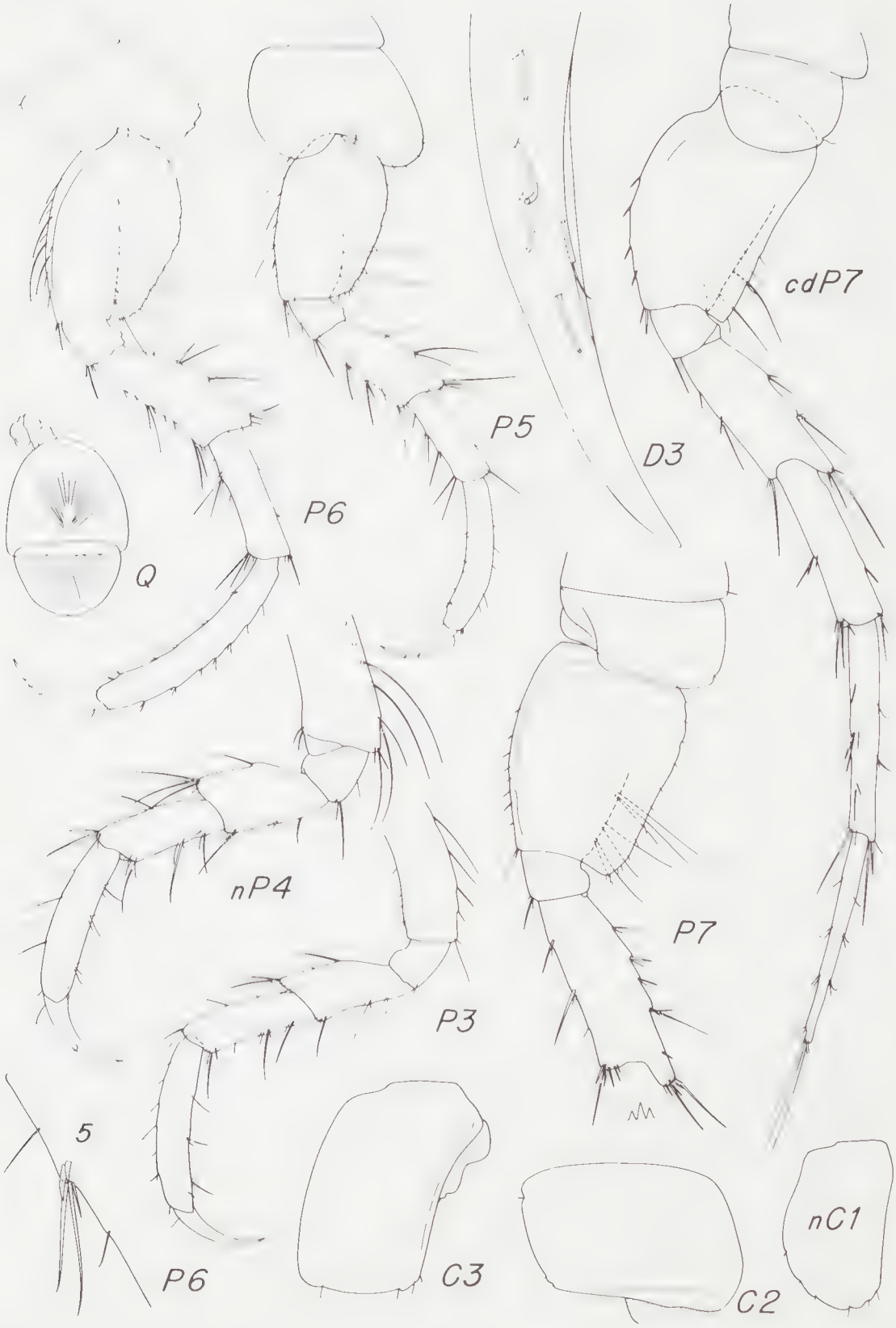
Pleopods ordinary, peduncle elongate, rami elongate, subequal and multiarticulate. No pleonal epimeron dominant, first with obsolescent, second and third each with sharp or subsharp medium tooth, posterior margins strongly convex, epimeron 1 with 3 facial spines and no anteroventral setae, epimeron 2 with 5 ventral but submarginal spines, epimeron 3 with 3 ventrofacial spines, all epimeral spines horizontal and in tandem. Uropods 1–2 extending equally, uropod 3 slightly failing same extension, dorsolateral margin of peduncle on uropod 1 with 6 spines, long gap between ultimate and penultimate, medial with one apical spine, outer ramus scarcely shorter than inner, outer with no dorsal spine, inner with 4. Peduncle of uropod 2 with 4 dorsolateral spines, medial with one apical, outer ramus shorter than inner, outer with 4 dorsal spines, inner with 4. Peduncle of uropod 3 elongate, with 3 dorsomedial spines, outer ramus scarcely shorter than inner, as long as peduncle, with 5 dorsal spines, inner with 3 dorsal spines, each ramus with subapical setule. Telson linguiform, entire, with 2 pairs of dorsolateral setules in middle and one apicolateral setule on each side and one basolateral setule on each side.

Female "n". Like male but antennae lacking calceoli, eyes smaller than male but much larger than male of *P. australis*, flagellum of antenna 1 with 10 articles, one aesthetasc each on articles 4, 6, 8, 9, rudimentary on 10; flagellum of antenna 2 [broken but presumed to lack calceoli also]. Coxae 1–4 longer than in male, coxa 1 somewhat nasiform and tapering distally, coxae 2–3 narrow, coxa 4 with better defined and quadrate posteroventral lobe. Oostegites 2–3 broad, 4–5 narrow and setose. Gnathopods feeble, equally slender and almost of same length, carpi as long (or longer) than propodi, gnathopod 1 much more slender and slightly more elongate than in male, carpi with weak apical lobe pointing weakly distad, propodus expanding apicad, palm slightly oblique; carpus of gnathopod 2 with strong posterior lobe situated distally and pointing distad, palm less oblique than on gnathopod 1. Pereopods 3–4 like male but article 4 broader. Pereopod 7 [on female "cd" with elongate dactyl bearing 3 long and several short apical setae, anterior and posterior margins each with 4 and 3 sets of short pairs of setae]. Spination on epimera and uropods varietal (probably not sexual), spines on epimera 1, 2, 3 = 2, 4, and 3. Lateral or dorsal spine formulas of peduncles on uropods 1, 2, 3 = 6, 4, 2; outer rami = 1, 4, 2; inner rami = 3, 4, 3.

Female "cd". Pereopod 7 drawn in entirety (most specimens of both sexes losing this appendage on death). Flagellum of antenna 1 with 7 articles, of antenna 2 with 8. Epimera 1–3 spine formula = 1-2-1. Uropodal spine formulas (peduncle, outer and inner rami respectively), uropod 1 = 5-0-1, uropod 2 = 3-2-3, uropod 3 = 2-1-1.

Young male "bc". Top and side of head illustrated because major adults with eyes shrunken after death. Flagellum of antenna 1 with 11 articles, one calceolus only on article 3, one aesthetasc each on articles 5, 7, 9, 10. Flagellum of antenna 2 with 12 articles, one calceolus each on articles 1, 2, 3. Spines on epimera 1–3 = 2-3-1.

Figure 6. *Paracalliope lowryi*, new species, unattributed figures = male "x", holotype, 5.07 mm; n = female "n" 3.48 mm; 0 = male "o" 3.83 mm.


cdP7
P5
D3
P6
Q
nP4
P7
P3
5
P6
C3
C2
nC1

Uropodal spine formulas (as above), uropod 1 = 7-0-1, uropod 2 = 3-3-3, uropod 3 = 3-1-2.

Aberrant male "ab". Tooth on epimera 2–3 small (illustrated) but epimeron 1 lacking anteroventral setae; spine count on epimera 1–3 = 1-2-0; spine counts on uropods (as above), uropod 1 = 5-0-1, uropod 2 = 2-2-2, uropod 3 = 1-0-1; each main flagellum of antennae 1-2 with 9 articles.

Aberrant male "mb". Tooth on epimera 2–3 especially large and notch above tooth stronger (illustrated); spine count on epimera 1–3 = 2-5-0, no anteroventral setae on epimeron 1; spine count on uropod 1 = 6-0-2, uropod 2 = 3-4-3, uropod 3 = missing; gnathopod 2 of *P. lowryi* form; mandibular palp article 3 normal, thus with 2 basofacial setae.

Aberrant male 665. Epimera 1–3 spine counts = 2-1-2, uropod 1 spine counts, uropod 1 = 7(gap normal)-2-3, uropod outer ramus = 4, inner = 3; uropod 3 outer ramus = 3, inner = 3.

Male "o". Gnathopod 2 illustrated (shrunken on holotype). Pereopod 7 broken. One calceolus each on articles 2, 3, 5 of antenna 1 flagellum. Spines of epimera 1–3 = 2-4-1. Spine formulas of uropods (as above), uropod 1 = 5-0-3, uropod 2 = 3-3-3, uropod 3 = 2-1-2.

Male "q". Pereopod 7 and uropod 3 broken. One calceolus each on articles 1, 3, 4, 5 of antenna 1 flagellum. Spines of epimera 1–3 = 1-3-1. Spine formulas of uropods (as above), uropod 1 = 6-0-3, uropod 2 = 3-4-4.

Female "p". Uropod 3 missing. Flagellum of antenna 1 with 7 articles. Spines of epimera 1–3 = 1-3-1. Spine formulas of uropods (as above), uropod 1 = 5-0-3, uropod 2 = 3-3-3.

Males "cd" and "cc" from P664, Cape Banks and male "jc" from P666, Jacksons Creek, Qld. Characterized by absence of spines on epimeron 3, male "jc" with no spines on outer ramus of uropod 1 and the others with one spine on that ramus. Male "jc" also lacks spines on the inner ramus of uropod 1. Males "cb" and "cc" have one spine on the inner ramus. Male "cc" has only 2 basofacial setae on article 3 of the mandibular palp and female "cf" has none (like *P. larai*). Female "cf" does have one spine on epimeron 3.

Six specimens from P665. Epimeron 3 with 2 spines.

Variations. There is considerable variation in several attributes of *P. lowryi* but we cannot link it to speciation. We are beset with the common dilemma of having material from widely separated localities that shows considerable variation but no morphological basis to divide the material into infraspecies. Much of the variation is expressed in counts of spines and setae which vary with the sizes of the demic members from various localities and with growth stages of both sexes. The samples appear to express a mixture of breeding seasons because fully terminal adults are often lacking.

For example, early in our studies we were able to separate adults of the freshwater *P. larai* from the brackish-marine *P. lowryi* by the presence of 0–1 spine on the outer ramus of *P. lowryi* (versus 2 spines in *P. larai*) but we finally found a specimen of *P. lowryi* from the type locality with the requisite 2 spines. Knott (1975) showed in his table 2 the wide variation in spines even in the limited material he had of a single species from one locality (20 observations). Juveniles and males generally have fewer spines on all 9 positions (counting peduncle and 2 rami for each of 3 uropods) of uropods than do females. We find this generally true of *P. lowryi* and can include similar results on epimera 1–3 but with some demes of *P. lowryi* entirely lacking spines on epimeron 3. Fortunately, all of our reported samples have both males and females; *P. lowryi* is therefore identifiable from the small male gnathopod 1.

Notes on material and illustrations. The material is difficult to analyse because of mostly broken pereopod 7 and antenna 2, often missing uropod 3 and usually shrunken eyes owing to collapse of cephalic tissues; from dorsal view, however, adult eyes are always seen as clearly larger than in *P. australis*. The head of the holotype is shown with collapsed eyes but male "bc" is illustrated with normal eyes. The molar is like that shown for *P. australis*. Spines on outer plate of maxilla 1 are often worn as shown in the holotype, but have normal extension as on female "n". Gills and female oostegites are similar to those shown for *P. australis*.

Etymology. Named for Dr James K. Lowry,

Figure 7. *Paracalliope lowryi*, new species, unattributed figures = male "x", holotype, 5.07 mm; cd = female "cd" 2.49 mm; n = female "n" 3.48 mm.

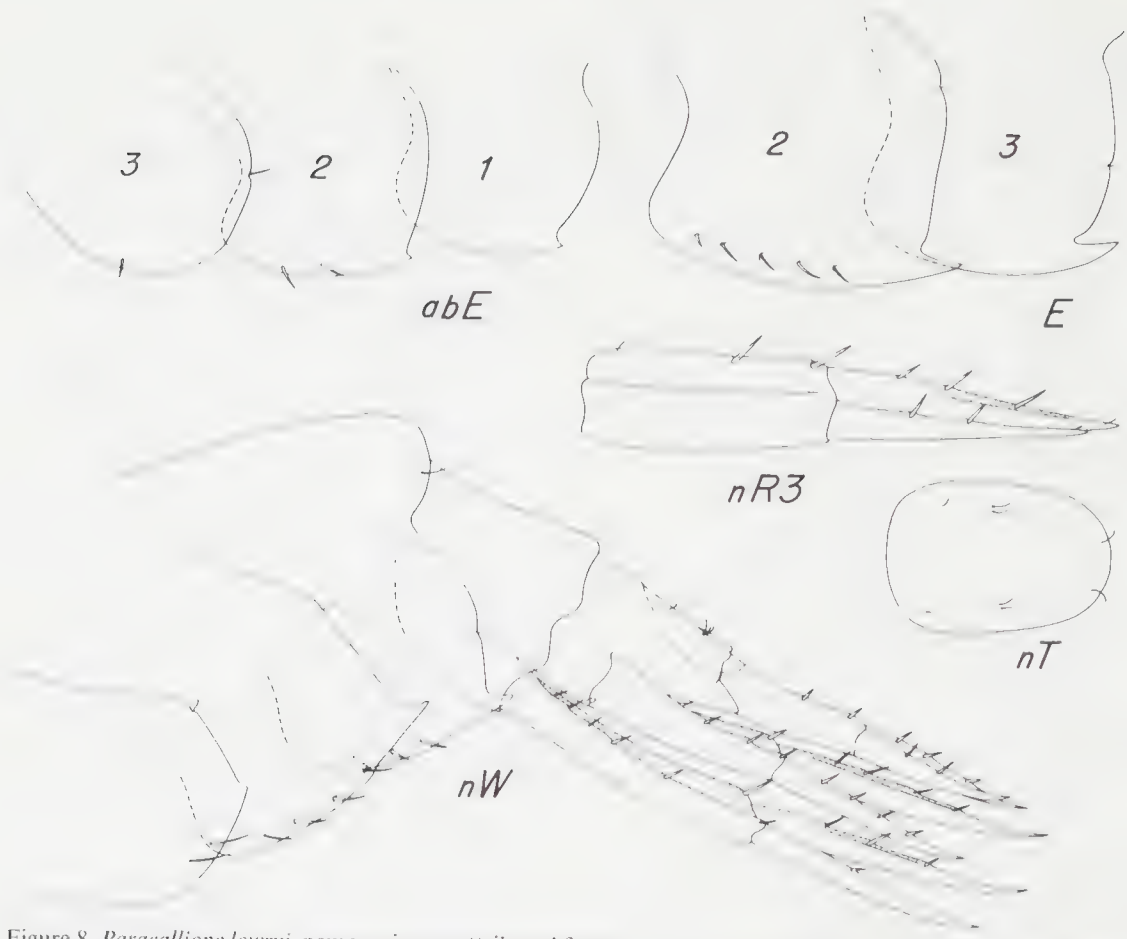


Figure 8. *Paracalliope lowryi*, new species, unattributed figures = male "x", holotype, 5.07 mm; ab = male "ab" 2.03 mm; n = female "n" 3.48 mm.

Curator of Crustacea, The Australian Museum, Sydney.

Relationship. This species is unique in *Paracalliope* for the small male gnathopod 1 which is like female gnathopod 1 in size and shape. This species differs from *P. australis* in: (1) the much larger eyes in both sexes; (2) the slightly different shape of head; (3) the weak setation of pereopods 3–4 in the male; (4) the lack of a slit in the dactyls of pereopods 3–6 (which is a very unreliable character in some of the *P. australis* material); (5) the larger teeth of epimera 2–3; (6) the absence of anteroventral setae on epimeron 1; (7) the long gap between ultimate and penultimate spines on the dorsolateral margin of the peduncle on uropod 1; (8) the reduction of spines on the outer ramus of uropod 1 to the formula 0-1; and (9) the presence of a pair of basofacial setae or a single spine-seta on article 3 of the mandibular palp. Minor differences found in *P. lowryi* include the stronger pubescence of the upper lip, the weakness of the bifid condition on the first right raker spine on the mandible; the slightly wider male coxa 1 relative to coxa 2; the less comma-shaped female coxa 1; broader female coxa 2; more strongly defined lobe of coxa 4; different shape of lobe on carpus of gnathopod 1; thinner and smaller male gnathopod 1; shorter article 6 relative to articles 4–5 on pereopods 3–4; longer spines on epimeron 1; and the presence of more (3) spines on the inner ramus of uropod 3 in the largest adults.

See *P. larai* and *P. vicinus* for distinctions from this species.

Distribution. Victoria, Tasmania and New South Wales, in estuaries and inlets, Gippsland lakes, intertidal.

Paracalliope vicinus sp. nov.

Figures 9–10

Material. Holotype. Tasmania. Big Waterhouse Lagoon, eastern shore, weeds, A.M.M. Richardson and J. King, 17 Jul 1973, NMV J22300 (male "wg", 5.33 mm).

Other material. Tasmania. Resolution Creek, Adventure Bay (43°21′S, 147°17′E), R. Mewbey, and B. Knott, 30 Sep 1972, NMV J6964 (5). Roger River tributary (41°04′S, 145°03′E), 25 Jan 1974, NMV J6971 (4). Shepherds Bay, in rock pool at N end of bay fed by freshwater draining from sand dunes (40°28′S, 144°47′E), brackish rock pool, 21 May 1974, NMV J6965 (many). Coal River, D. Coleman, 29 Nov 1974, NMV J6958 (mating pairs). Small tributary of Scamander River, T.M. Walker and P. Suter, 6 May 1975, NMV J6978 (6). Moth Creek, Maleleuca, Port Davey, 1 m, mud, plant debris, J.M. Fenton, 12 Apr 1974, NMV J6979 (6). Randys Creek, NMV J6950 (many). Apsley River, at Tasman Highway crossing past Bicheno, T. Walker, 17 Aug 1972, NMV J6975 (2). Camp Creek, Currie, King Island, B. Knott, 31 Jul 1971, NMV J6962 (5). N shore of Narrows, entrance to Bathurst Harbour, under rock, brackish water, J.M. King, 16 Aug 1973, NMV J6966 (7). Jordan River at Apsley, D. Coleman, 6 Jun 1974, NMV J6968 (many). Ettrick River, ti tree clump just above road, saline, B. Knott, 31 Jul 1971, NMV J6972 (21). Big Waterhouse Lagoon, eastern shore, weeds, A.M.M. Richardson and J. King, 17 Jul 1973, NMV J6974 (many). Melton Mowbray, Jordan River, B. Knott, 13 Apr 1972, NMV J6949 (12). Catamaran, creeks draining across sand, P.S Lake et al., 25 Jun 1972, NMV J6959 (many). Browns River, P.S. Lake, 1 Apr 1978, NMV J6973 (many). Randys Creek, D. Coleman, 4 Dec 1974, NMV J6960 (many). Coal River, near Richmond, V. Thorpe, NMV J6957 (many). Tributary of Drew River, Hamilton – Hollow Tree Road, B. Knott, 10 Oct 1972, NMV J6955 (1). Flowerdale River at Flowerdale, Mewbey et al., 9 Feb 1973, NMV J6963 (2). Creek draining inland through cow paddocks, along road to Temma, just before drop into Arthur River, Mewbey et al., 8 Feb 1973, NMV J6969 (many). Duck River, Smithton, Mewbey et al., 7 Feb 1973, NMV J6970 (many). Moth Creek, Maleleuca, Port Davey, 1 m, mud, plant debris, G.M. Fenton, 12 Apr 1974, NMV J22294 (female voucher "q", 3.22 mm illustrated). Big Waterhouse Lagoon, eastern shore, weeds, A.M.M. Richardson J. King, 17 Jul 1973, NMV J22299 (female voucher "wj", 3.00 mm), NMV J22298 (female voucher "wi", 3.56 mm), NMV J22295 (male voucher "d", 3.81 mm), NMV J22297 (male voucher "wh", 4.90 mm). Camp Creek, Currie, King Island, B. Knott, 31 Jul 1971, NMV J22296 (male voucher "cz", 4.86 mm).

Victoria. Hopkins River, G. Newton, 13 Dec 1985, NMV J6996 (1).

State unknown. Lambert Park Creek, 30 Jun 1972, NMV J6956 (many).

Description. Holotype, male "wg". Rostrum small, lateral cephalic lobe bluntly coniform, sinus receiving antenna 2 moderate, eyes medium, widely separate. Antenna 1 scarcely shorter than antenna 2, flagellum with 14 articles, one calceolus each on articles 2, 3, 4, 5, 7; one aesthetasc each on articles 6, 8, 10, 12, 13, and rudimentary on 14. Gland cone of antenna 2 very prominent, almost reaching apex of article 3 (in lateral view), flagellum with 14 articles, one calceolus each on articles 2, 4, 6, 8.

Epistome flat anteriorly, upper lip articulate and rounded-truncate below, anterior pubescence poorly developed. Mandibles of basic gammaridean plan, incisors toothed, right and left laciniae mobiles toothed, right and left rakers 3 and 4 respectively; molar triturative, bearing apical seta; palpar hump small, articles 1–2 naked, article 3 especially pubescent, formula of spines = 3A, 10D, 4E, with all of E setae simple, others penicillate, basofacial setae present. Inner lobes of lower lip well developed and fleshy. Inner plate of maxilla 1 almost fully setose medially (but left side aberrant, only setose halfway), outer plate with 11 diverse spines, palp 2-articulate, spinose apically, right and left palps alike. Plates of maxilla 2 subequal in size, inner with facial row of setae. Inner and outer plates of maxilliped weakly spinose, palp short, stout, dactyl unguiform, with 5 accessory setules.

Coxae 1–7 short, almost glabrous, almost of even depth except coxa 7 shortened, coxa 1 scarcely expanded in middle, coxa 4 weakly excavate posteriorly and weakly lobate posteroventrally; coxae 2–6 each with narrow sac-like gill with pediculate base. Large lobe on carpus of gnathopod 1 pointing slightly distad, propodus ovately expanded, palm about as long as posterior margin of propodus, well defined by change in slope, palm with organized clusters of armaments, dactyl fitting palm, with several subapical setules. Carpus of gnathopod 2 forming complex of 2 basal swellings side by side and thin posterior lobe curving distad, propodus turning inward on death, ovatorectangular, palm oblique, moderately and raggedly excavate, with 4 lateral and 4 medial facial spines proximal to ragged margin, dactyl slender, fitting palm.

Article 4 of pereopods 3–6 slender, posterior margins of articles 4–6 of pereopods 3–4 with moderately long setae in fascicles, generally fascicle formula number on articles 4–6 = 3-4-6, each fascicle with 1–4 setae (see illustration).


G1
jE
G2
G2
W
qW

Each of pereopods 3–6 with conspicuous slit on dactyls, all with setules. Pereopods 5–6 of ordinary amphipod dimensions, 6 slightly larger than 5, article 2 ovate, poorly produced posteroventrally, almost smooth, each with midfacial ridge, that on pereopod 5 naked, that on pereopod 6 setose. Pereopod 7 enlarged, article 2 broad and subquadrate, weakly and subsharply produced posteroventrally, dactyl 95% as long as article 6, with 4 anterior fascicles of setae, numerous single posterior setae in tandem and 8 apical setae.

Pleopods ordinary, peduncle elongate, rami elongate, subequal and multiarticulate. No pleonal epimeron dominant, epimeron 1 with tiny posteroventral tooth, epimera 2–3 each with medium tooth, each with strongly convex posterior margin, epimeron 1 with 2 facial spines and no anteroventral setae, epimeron 2 with 5 ventral but submarginal spines in tandem horizontally, epimeron 3 with 3 submarginal spines in tandem horizontally. Uropods 1–2 extending subequally, uropod 3 slightly failing same extension, dorsolateral margin of peduncle on uropod 1 with 10 spines, no discernible apical gap, medial with one apical spine, outer ramus scarcely shorter than inner, outer with 1 dorsal spine, inner with 3. Peduncle of uropod 2 with 3 dorsolateral spines, medial with one apical, outer ramus shorter than inner, with 3 dorsal spines, inner with 4. Peduncle of uropod 3 elongate, with 2 dorsomedial spines and basal setule, outer ramus as long as inner, slightly shorter than peduncle, with 3 dorsal spines, inner with 2 dorsal spines, each ramus with subapical setule. Telson linguiform, entire, with 2 pairs of dorsolateral setules in middle and one apicolateral setule on each side.

Male "q" 3.22 mm. Teeth of epimera 2–3 slightly enlarged (Fig. 9qW), outer ramus of uropod 1 lacking spine, apical gap present on dorsal spines of peduncle on uropod 1, setae on pereopods 3–4 weak.

Female "wj" 3.00 mm. Like male but eyes much smaller, antennae broken, see female "wi" below. Coxae 1–4 longer than in male. Oostegites 2–3 broad, 4–5 narrow and setose. Gnathopods feeble, equally slender, 2 slightly longer, carpi shorter than propodi, gnathopod 1 much more slender and slightly more elongate than in male, carpus with large lobe pointing distad, propodus subrectangular but weakly expanding apically, palm subtransverse; carpus of gnathopod 2 with large posterior lobe pointing distad, palm subtransverse. Pereopods 3–4 poorly setose compared with male but setae better developed than in male of *P. lowryi* (see illustration of *P. lowryi).* Pereopod 7 with dactyl 85% as long as article 6. Spines of epimera 1–3 = 2-3-1. Uropods outer and inner rami respectively with spines as follows: uropod 1 = 2 and 3, uropod 2 = 3 and 4, uropod 3 = 2 and 1; peduncle of uropod 1 with spines in formula: 1-1-1-1-1-gap-1-gap-1, peduncle of uropod 2 with 3 spines, of 3 with 2.

Male "qr" 4.27 mm. Tooth of epimera 2–3 large as in *P. larai* but mandibular palp with 3 A-B setae, epimeron 3 with 3 ventral spines, therefore identified as *P. vicinus.*

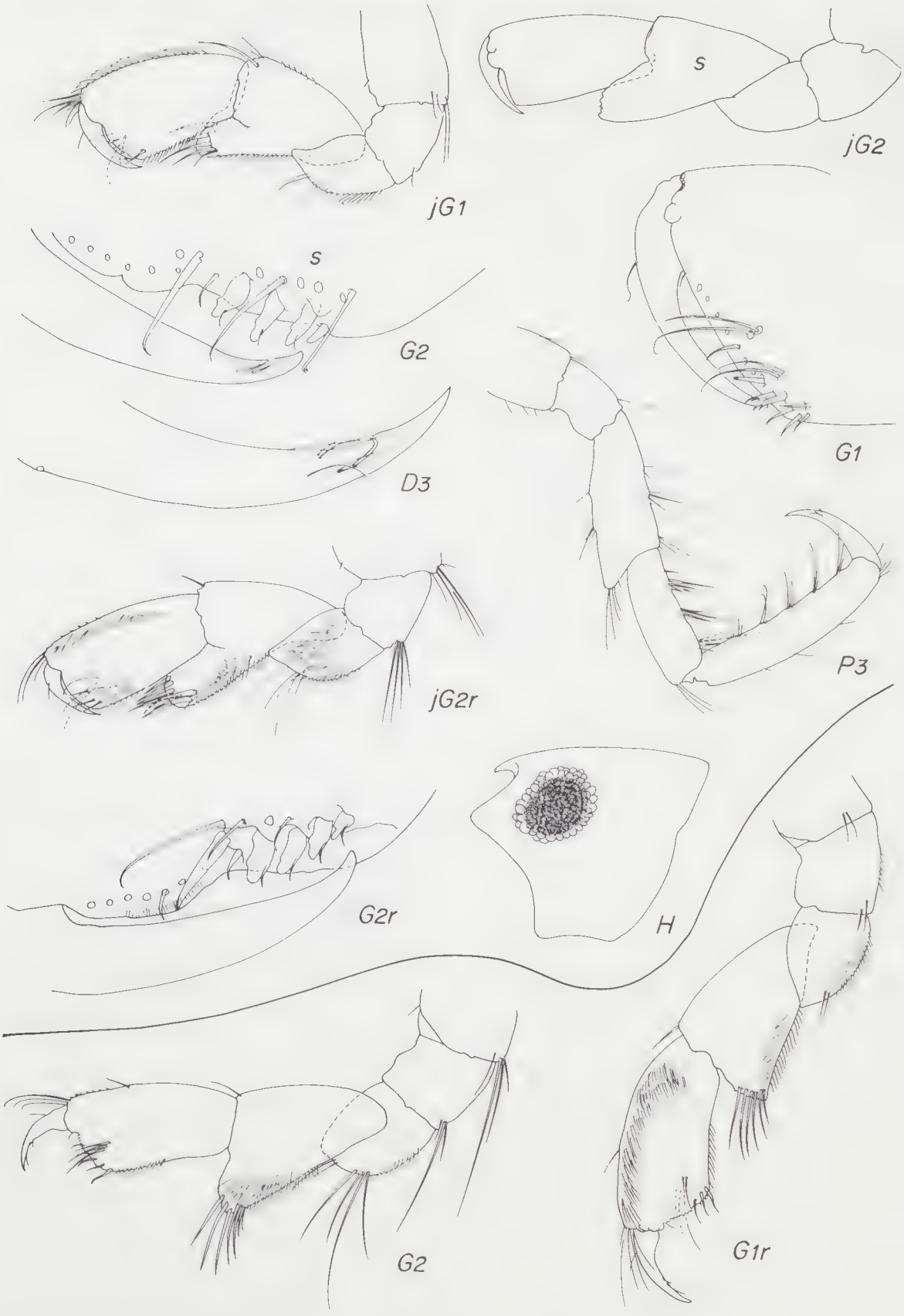
Female "wi" 3.56 mm. Flagella of antennae 1 and 2 with 11 and 12 articles, calceoli and aesthetascs absent.

Specimens from NMV J6961, Kellevie. Tooth of epimera 2–3 as large as in *P. lowryi* but identified as *P. vicinus* because male gnathopod 1 enlarged, male setae of pereopods 3–4 of the longer form, eyes small, outer ramus of uropod 1 without spines.

Relationship. This species is apparently most similar to *P. larai* but differs in the slightly smaller teeth of epimera 2–3, the lack of a significant excessive gap in the spination sequence on the peduncle of uropod 1, the better developed setae on male pereopods 3–4, the presence of 3 spines on epimeron 3 in adults, the presence of only 1 spine (rarely 2) on the outer ramus of male uropod 1, and the fully developed basofacial setae on article 3 of the mandibular palp. The similarity between the two species resides in the almost identical conditions of male gnathopod 1 and female gnathopods 1–2.

This species differs from *P. lowryi* in the large male gnathopod 1, the slightly smaller teeth on epimera 2–3, lack of significant gap in spination on peduncle of uropod 1, slightly better developed setation of male pereopods 3-4, the enlarged gnathopod 1 (like *P. larai*) which is a small replica of male gnathopod 2, with short carpus, deep carpal lobe and expanded propodus; in the stouter female gnathopod 1 with carpus relatively enlarged, its lobe larger and the

Figure 9. *Paracalliope vicinus*, new species, unattributed figures = male holotype "wg" 5.33 mm; j = female "wj" 3.00 mm; q = male "q" 3.22 mm.


jG1
s
jG2
s
G2
G1
D3
P3
jG2r
G2r
H
G2
G1r

propodus more expanded; in female gnathopod 2 with larger carpal lobe and shorter anterior margin of carpus.

It differs from *P. australis* in the slightly larger teeth of epimera 2–3, the slightly lesser development of setae on male pereopods 3–4, the very slightly larger male gnathopod 1 with articles 5–6 slightly more expanded; the much stouter female gnathopod 1 with much larger carpal lobe, shorter carpus, and more expanded articles 5–6; the larger carpal lobe of female gnathopod 2; and the well developed basofacial setae on article 3 of the mandibular palp.

It differs from from *P. novizealandiae* in the reduced spination on the outer ramus of uropod 1, the presence of more AB setae on the mandibular palp, and the larger carpal lobes on the female gnathopods.

It differs from *P. fluviatilis* in the stouter propodi of female gnathopod 1, the lack of spines on epimeron 3 and possibly the presence of more posterior setal groups on article 6 of pereopods 3–4 (but we are comparing males with females of the different species). The two species are otherwise virtually identical. The spines on uropods 1–2 were not described in *P. fluviatilis*.

It differs from *P. karitane* in the presence of spines on epimeron 3, the larger carpal lobes on female gnathopods, the presence of more AB setae on the mandibular palp and the reduced spination on uropods 1–3.

Etymology. Vicinus (L.), near, in reference to the similarity of this species to *P. larai*.

Distribution. Tasmania, lagoons, estuaries, inlets, creeks, apparently mostly fresh water, in marine localities apparently in trickles of freshwater crossing mudflats, intertidal.

Paracalliope larai Knott

Figures 11–13

Paracalliope larai Knott, 1975: 40–48, figs 1–25b.

Material. Holotype. Tasmania, Dip River above falls, 200 m altitude, 23 km direct line from Bass Strait, 1973–1974, Tasmanian Museum G1625 (male).

Paratypes. Type locality, TM G1626 a, b, G1627 a, b (30 specimens).

Other material. Tasmania. Dip Falls, AMMM, JLH & PS, 30 Nov 1974, NMV J6948 (many), NMV J22288 (male voucher "d", 2.57 mm, maxilliped illustrated), NMV J22289 (male voucher "a", 2.54 mm, J22289 illustrated), NMV J22290 (male voucher "c", 2.67 mm), NMV J22293 (female voucher "w", 2.05 mm, J22293 illustrated), NMV J22291 (female voucher "e", 1.94 mm), NMV J22292 (female voucher "v", 1.80 mm).

Note. The holotype male and one female were examined by us many years ago and the following descriptions, minus body measurements are presented. New figures were made from topotypic material in the Museum of Victoria, male "a" and female "w" to follow.

Description. Male holotype. Rostrum small, lateral cephalic lobe adze-shaped, sinus receiving antenna 2 deep, eyes small (artificially shrunken), widely separate. Antenna 1 scarcely shorter than antenna 2, flagellum with 14 articles, calceoli absent; one aesthetasc each on articles 9, 11, 12, 13, and rudimentary on 14. Gland cone of antenna 2 very prominent, almost reaching apex of article 3 (in lateral view), flagellum with 10 articles, one calceolus each on articles 3, 4.

Epistome flat anteriorly, upper lip articulate and rounded-truncate below, anterior pubescence poorly developed. Mandibles of basic gammaridean plan, incisors toothed, right and left laciniae mobiles toothed, right rakers 4, first raker bifid (possibly 2 rakers fused?); molar triturative, bearing apical seta; palpar hump small, articles 1–2 naked, article 3 especially pubescent, formula of spines = 3D, 5E, with 3 of E setae simple, others penicillate, basofacial setae absent. Inner lobes of lower lip well developed and fleshy. Inner plate of maxilla 1 almost fully setose medially, outer plate with 11 diverse spines, palp 2-articulate, spinose apically, right and left palps alike. Plates of maxilla 2 subequal in size, inner with facial row of setae. Inner and outer plates of maxilliped weakly spinose, palp short, stout, dactyl unguiform, with about 2 accessory setules.

Coxae 1–7 short, almost glabrous, almost of even depth except coxa 7 shortened, coxa 1 scarcely expanded in middle, coxa 4 weakly excavate posteriorly and weakly lobate posteroventrally; coxae 2–6 each with narrow sac-like gill with pediculate base. Medium sized lobe on carpus of gnathopod 1 pointing slightly distad, propodus ovately expanded, palm about as long as posterior margin of propodus, well defined by change in slope, palm with organized clusters of armaments, dactyl fitting palm, with several

Figure 10. Upper, *Paracalliope vicinus*, new species, unattributed figures = holotype male "wg" 5.33 mm; j = female "wj" 3.00 mm. Lower, *Paracalliope australis*, female "tn" 2.60 mm.

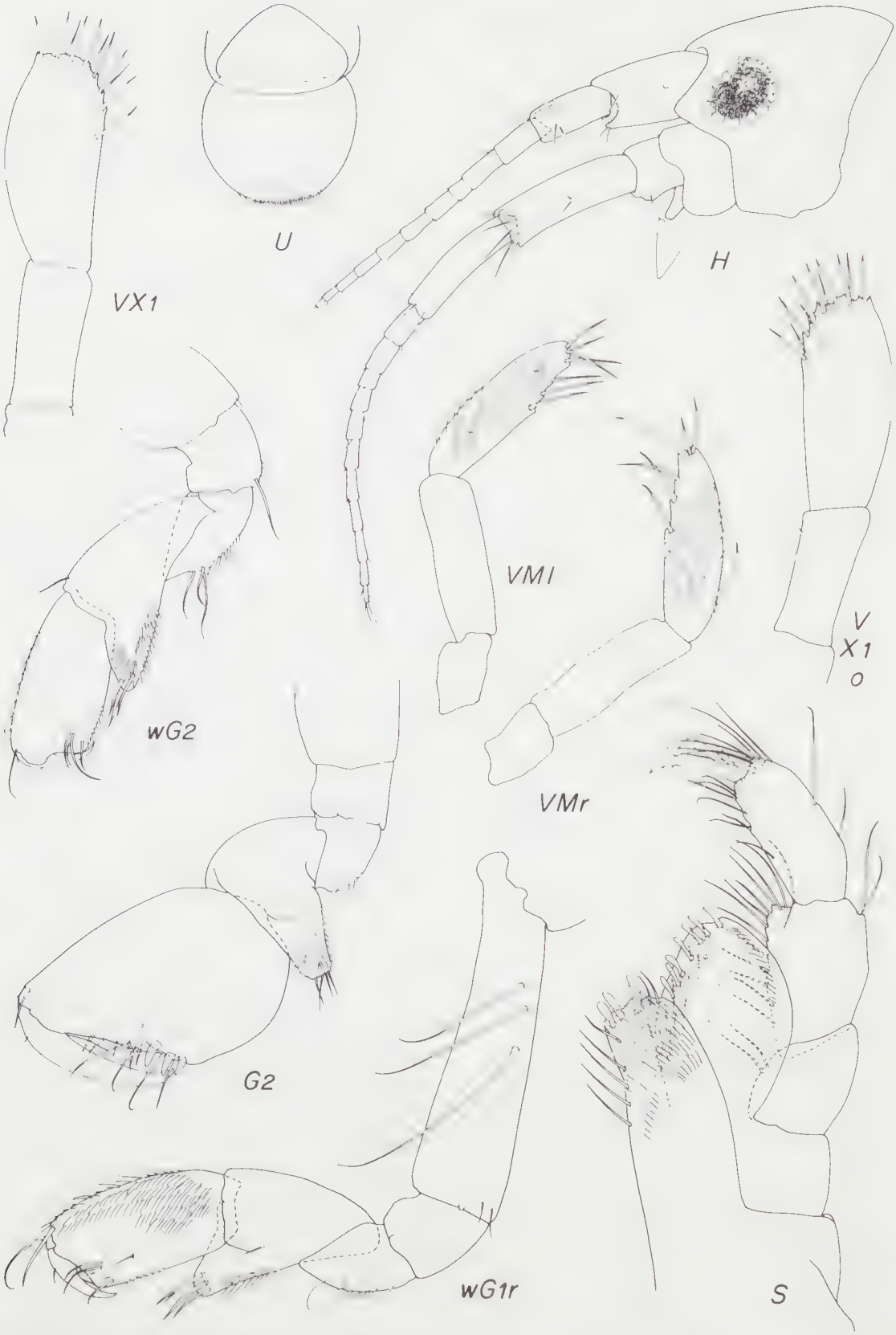


Figure 11. *Paracalliope larai*, unattributed figures = male "a" 2.54 mm; w = female "w" 2.05 mm.

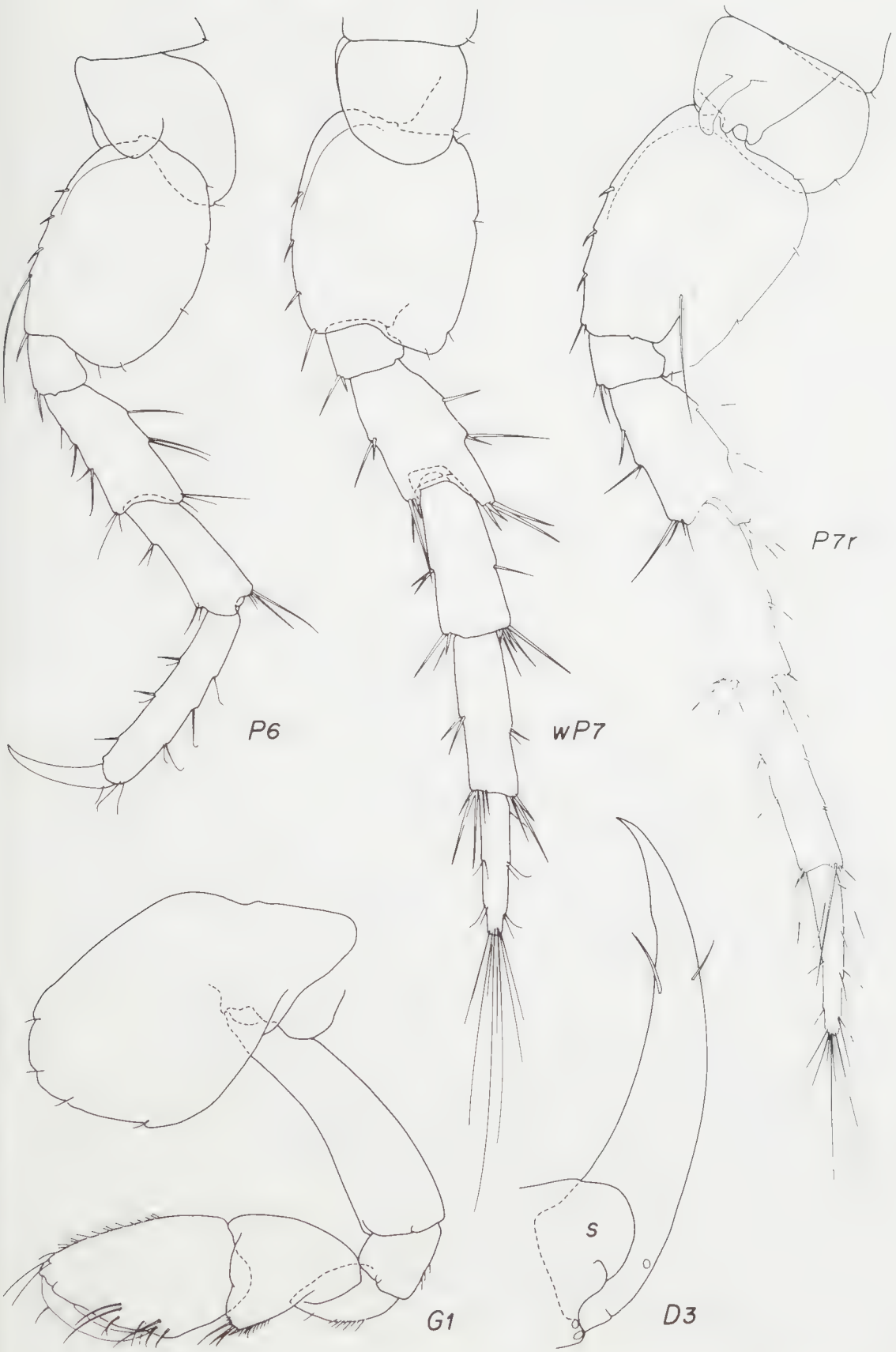
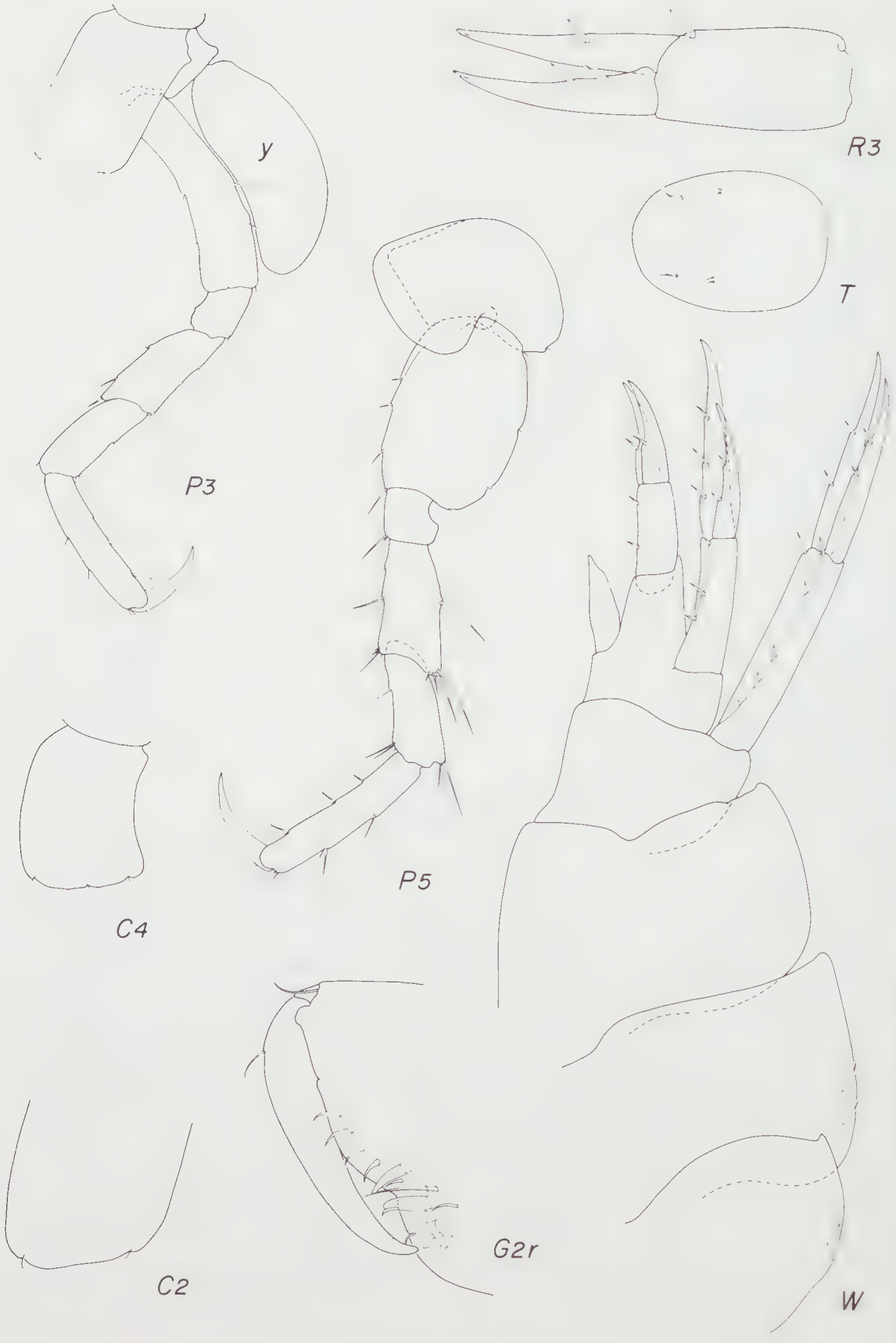


Figure 12. *Paracalliope larai*, unattributed figures = male "a" 2.54 mm; w = female "w" 2.05 mm.


y
P3
R3
T
P5
C4
G2r
C2
W

subapical setules. Carpus of gnathopod 2 forming complex of 2 basal swellings side by side and thin posterior lobe curving distad, propodus turning inward on death, ovatorectangular, palm oblique, deeply and raggedly excavate, with 2 lateral and 4 medial facial spines proximal to ragged margin, dactyl slender, fitting palm.

Article 4 of pereopods 3–6 slender, posterior margins of articles 4–6 of pereopods 3–4 with moderately long setae in fascicles, generally fascicle formula number on articles 4–6 = 4-6-5, each fascicle with 1–4 setae (see illustrations). Only one member each of pereopods 3 and 6 with conspicuous slit on dactyls, all with setules. Pereopods 5–6 of ordinary amphipod dimensions, 6 slightly larger than 5, article 2 ovate, poorly produced posteroventrally, almost smooth, each with midfacial ridge, that on pereopod 5 naked, that on pereopod 6 setose. Pereopod 7 enlarged, article 2 broad and subquadrate, weakly and subsharply produced posteroventrally, dactyl over 110% as long as article 6, with about 6 anterior fascicles of setae, numerous single posterior setae in tandem and 10+ apical setae.

Pleopods ordinary, peduncle elongate, rami elongate, subequal and multiarticulate. No pleonal epimeron dominant, each with tiny posteroventral tooth and weakly to strongly convex posterior margin (epimeron 2 weakest), epimeron 1 with 1–2 (L + R) facial spines and 3 anteroventral setae, epimeron 2 with 3–4 (R + L) ventral but submarginal spines in tandem horizontally, epimeron 3 with 1 submarginal spine and 1 setule in tandem horizontally near anteroventral edge. Uropods 1–2 extending subequally, uropod 3 slightly failing same extension, dorsolateral margin of peduncle on uropod 1 with 7 spines, and discernible apical gap, medial with one apical spine, outer ramus scarcely shorter than inner, outer with 1 dorsal spine, inner with 1. Peduncle of uropod 2 with 2 dorsolateral spines, medial with one apical, outer ramus shorter than inner, outer with 2 dorsal spines, inner with 2. Peduncle of uropod 3 elongate, with 1 dorsomedial spine and basal setule, outer ramus scarcely shorter than inner, as long as peduncle, with 1 dorsal spine, inner with 1 dorsal spine, each ramus with subapical setule. Telson linguiform, entire, with 2 pairs of dorsolateral setules in middle and one apicolateral setule on one side only.

Female. Pereopod 7 broken. Like male but antennae lacking calceoli, flagellum of antenna 1 with 11 articles, one aesthetasc each on articles 6, 8, 9, 10, 11 (rudimentary); flagellum of antenna 2 with 13 articles. Coxae 1–4 longer than in male, coxa 1 somewhat nasiform and posteroventrally extended, coxae 2-3 narrow, coxa 4 with strongly beveled ventral margin toward posterior side. Oostegites 2–3 broad, 4–5 narrow and setose. Gnathopods feeble, equally slender and almost of same length, carpi as long as propodi, gnathopod 1 much more slender and slightly more elongate than in male, carpus with large lobe pointing distad, propodus subrectangular but weakly expanding apically, palm subtransverse; carpus of gnathopod 2 with weak posterior lobe, palm oblique. Pereopods 3–4 poorly setose compared with male (see illustrations). See female "s" for pereopod 7 distinction below. Differences of epimera probably varietal (see illustration), one spine of epimeron 1 more ventrad, one of epimeron 2 poorly developed, one of epimeron 3 missing and other weak. Some uropods better spined than in male; outer and inner rami respectively with spines as follows: uropod 1 = 3 and 3, uropod 2 = 3 and 3, uropod 3 = 2 and 2.

Male "a". Topotypic specimen illustrated; written material here describing and clarifying attributes not illustrated; flagellum of antenna 1 with one calceolus each on articles 1 and 2; flagellum of antenna 2 with one calceolus each on articles 2, 4 and 6; following parts like our figures of *P. australis*: accessory flagellum; lower lip; and other mouthparts with following variations: right mandible, except palp (figured); left mandible, except lacinia mobilis with 5 teeth; inner plate of maxilla 1 with 16 setae; inner plate of maxilla 2 with 12 setae in facial row; inner plate of maxilliped with 5 medial setae, no apicofacial medial spinule; pereopod 4 like pereopod 3, size identical; gills of coxae 2, 4, 5, 6 all like figured gill of coxa 3.

Female "w". Gnathopods and pereopod 7 illustrated; otherwise like male "a" but smaller, armaments fewer; eyes also large as in male; flagellum of antenna 1 with 7 articles, of antenna 2 with 7 articles; calceoli absent; article 2 of gnathopod 2 lacking any enlarged setae; oostegites normal for genus, of coxa 3 largest and broadly ovate, of coxa 2 similar but slightly smaller, of coxa 4 slender, of coxa 5 shorter than 4 but

Figure 13. *Paracalliope larai*, male "a" 2.54 mm.

slightly wider; gills of coxae 2–6 sac-like, longer than broad, generally similar but minor size gradient from large to slightly smaller in this order: 4, 5, 6, 3, 2; epimeron 1 lacking anteroventral setules, epimera 1–3 with 1-2-0 ventral spines, posteroventral tooth as in male; peduncles of uropods 1–3 with 3-2-1 spines, inner and outer rami respectively with 2-2, 2-3, 1-1 spines.

Remarks. We have examined the holotype and paratypes. We have only three corrections to make to Knott's fine description. According to his description the accessory flagellum is absent and no basofacial setae occur on the third article of the mandibular palp. In fact, the holotype has one thick and short basofacial spine whereas many of the paratypes lack this element. An articulate accessory flagellum is present on the holotype and paratypes. The cephalic-ocular lobe is not as sharp as depicted by Knott.

Relationship. The male of *Paracalliope larai* differs from *P. lowryi* in the enlarged gnathopod 1 which is like male gnathopod 2, has larger eyes more closely appressed, and has only 0–1 basofacial seta on mandibular palp article 3; in the female the carpus of gnathopod 1 is shorter and lobe larger compared to *P. lowryi*.

The vast majority of adult specimens of *P. lowryi* have spines on epimeron 3 and less than 2 spines on the outer ramus of uropod 1, whereas all adult specimens of *P. larai* lack spines on epimeron 3 but have 2+ spines on the outer ramus of uropod 1. Unfortunately, to ameliorate absolute characterization, there are a few specimens of *P. larai* from the Dip River above the falls which also lack spines on epimeron 3 and at least one other specimen which has 1 spine on the outer ramus of uropod 1.

The presence (*P. lowryi*) or absence (*P. larai*) of basofacial setae on mandibular palp article 3 would be a good character difference except that the holotype of *P. larai*, in contrast to several of its paratypes, has one basofacial spine-seta.

The rather strong ecological difference between the provenance of *P. larai* (200 m altitude in a freshwater stream above or near a falls) and *P. lowryi* (lagoons and high tide pools) suggests to us that there is a distinction between these two "species" but obviously further studies of specimens in freshwater streams may demonstrate that the weak differences we have found are at best phenotypic.

Paracalliope larai differs from other species of the genus in Australia and New Zealand in the broadly sweeping posterior concavity leading directly to the posteroventral tooth on epimera 2–3.

Distribution. Tasmania, Dip Falls and stream above falls.

Acknowledgements

We thank the numerous collectors of material and owe special thanks for assistance to Drs G.C.B. Poore, J.K. Lowry, P.B. Berents, and Mr Robin Wilson; and to Mrs E. Harrison-Nelson for help in the laboratory. Carolyn Cox Lyons (Figures 1–8) of New York City and Linda B. Lutz (Figures 9–13) of Vicksburg, Mississippi, inked our illustrations.

References

Barnard, J.L., 1972. The marine fauna of New Zealand: algae-living littoral Gammaridea (Crustacea Amphipoda). *New Zealand Oceanographic Institute Memoir* 62: 7–216, 109 figs.

Barnard, J.L. and Barnard, C.M., 1983. *Freshwater Amphipoda of the World, I. Evolutionary Patterns; II. Handbook and Bibliography.* xix, 830 pp., 50 figs, 7 graphs, 98 maps, 12 tables. Hayfield Associates: Mt Vernon.

Barnard, J.L., and Drummond, M.M., 1976. Clarification of five genera of the Phoxocephalidae (marine Amphipoda). *Proceedings of the Biological Society of Washington* 88: 515–547, 4 figs.

Barnard, J.L. and Drummond, M.M., 1978. Gammaridean Amphipoda of Australia, part III: the Phoxocephalidae. *Smithsonian Contributions to Zoology* 245: 1–551, 269 figs.

Barnard, J.L. and Drummond, M.M., 1979. Gammaridean Amphipoda of Australia, part IV. *Smithsonian Contributions to Zoology* 269: 1–69, 38 figs.

Barnard, J.L. and Drummond, M.M., 1982. Gammaridean Amphipoda of Australia, part V: superfamily Haustorioidea. *Smithsonian Contributions to Zoology* 360: 1–148, 58 figs.

Barnard, J.L. and Drummond, M.M., 1984. A new paracalliopiid, *Katocalliope kutyeri* gen. et sp. nov. (Crustacea: Amphipoda) from Queensland. *Proceedings of the Royal Society of Victoria* 96: 147–153, 4 figs.

Barnard, J.L. and Drummond, M.M., 1987. A new marine genus, *Doowia*, from eastern Australia (Amphipoda, Gammaridea). *Proceedings of the Royal Society of Victoria* 99: 117–126, 6 figs.

Barnard, J.L., and Karaman, G.S., 1982. Classificatory revisions in gammaridean Amphipoda (Crustacea), part 2. *Proceedings of the Biological Society of Washington* 95: 167–187, fig. 1.

Barnard, J.L. and Thomas, J.D., 1991. *Yhi yindi*, a new genus and species of Paracalliopiidae from the Great Barrier Reef. *Memoirs of the Museum of Victoria* 52: 283–289, figs 1–3.

Chapman, A. and Lewis, M., 1976. *An introduction to the freshwater Crustacea of New Zealand.* Collins: Auckland. 261 pp., 161 figs., 8 pls.

Chilton, C., 1909. The Crustacea of the Subantarctic Islands of New Zealand. In: Chilton. C. (Ed.), *Subantarctic Islands of New Zealand* 26: 601–671, 19 figs. John Mackay; Wellington.

Chilton, C., 1920. The occurrence in Brisbane River of the New Zealand amphipod, *Paracorophium excavatum* (G.M. Thomson). *Memoirs of the Queensland Museum* 7: 44–51, 19 figs.

Chilton, C., 1921. The occurrence in the Philippine Islands of the fresh-water amphipod *Paracalliope fluviatilis* (G.M. Thomson). *Philippine Journal of Science* 17: 513–514.

Dana, J.D., 1852. Conspectus crustaceorum quae in orbis terrarum circumnavigatione, Carolo Wilkes e classe Reipublicae Faederatae Duce, lexit et descripsit Jacobus D. Dana. Pars III. [Amphipoda. No. I.]. *Proceedings of the American Academy of Arts and Sciences* 2: 201–220.

Dana, J.D., 1853. Crustacea. *United States Exploring Expedition during the Years 1838, 1839, 1840, 1841, 1842. Under the command of Charles Wilkes, U.S.N.* 14: 689–1618, atlas of 96 pls.

Della-Valle, A., 1893. Gammarini del Golfo di Napoli. *Fauna und Flora des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. Monographie* 20: xi, 948 pp., atlas (Atlante) of 61 pls.

Fearn-Wannan, H.J., 1968. Littoral Amphipoda of Victoria. Part 1. *Proceedings of the Royal Society of Victoria* n.s., 81: 31–58, 18 figs.

Haswell, W.A., 1880. On some new amphipods from Australia and Tasmania. *Proceedings of the Linnean Society of New South Wales* 5: 97–105, pls 5–7.

Haswell, W.A., 1882. *Catalogue of the Australian Stalk- and Sessile-Eyed Crustacea.* (plus Addenda et Corrigenda), Australian Museum: Sydney. xxiv, 324 pp., 4 pls.

Hurley, D.E., 1975. A provisional key and checklist to the New Zealand species of freshwater Amphipoda. *New Zealand Oceanographic Institute, Records* 2: 93–102.

Knott, B., 1975. A new species of freshwater amphipod, *Paracalliope larai,* (family Eusiridae) from Tasmania. *Papers and Proceedings of The Royal Society of Tasmania* 109: 39–52, 25 figs.

Lewis, M.H., 1976. Amphipoda. Chapter 11 in Chapman, A. and Lewis, M., *An introduction to the freshwater Crustacea of New Zealand.* Collins: Auckland. 261 pp., 161 figs., 8 pls.

Lincoln, R.J., and Hurley, D.E., 1981. The calceolus, a sensory structure of gammaridean amphipods (Amphipoda: Gammaridea). *Bulletin of the British Museum of Natural History (Zoology)* 40: 103–116, 4 figs.

Myers, A.A., 1985. Shallow-water, coral reef and mangrove Amphipoda (Gammaridea) of Fiji. *Records of the Australian Museum Supplement* 5: 1–144, 109 figs.

Ruffo, S., and Vesentini-Paiotta, G., 1972. Études hydrobiologiques en Nouvelle-Calédonie (Mission 1965 du Premier Institut de Zoologie de l'Université de Vienne). Anfipodi (Crust.) della Nuova Caledonia. *Cahiers ORSTOM, Serié Hydrobiologia* 6: 247–260, 8 figs.

Stebbing, T.R.R., 1899. Revision of Amphipoda (continued). *Annals and Magazine of Natural History* series 7. 4: 205–211.

Thomson, G.M., 1879. New Zealand Crustacea, with descriptions of new species. *Transactions and Proceedings of the New Zealand Institute* 11: 230–248, pl. 10.

Thomson, G.M., and Chilton, C., 1886. Critical list of the Crustacea Malacostraca of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 18: 141–159.

Memoirs of the Museum of Victoria 53(1): 31–41 (1992)

A NEW SPECIES OF *PAGURIXUS* (CRUSTACEA: DECAPODA: PAGURIDAE) FROM SOUTHERN AUSTRALIA

By S. W. Gunn[1] and Gary J. Morgan[2]

[1] Department of Crustacea, Museum of Victoria, Swanston Street, Melbourne, Victoria 3000, Australia
[2] Department of Aquatic Invertebrates, Western Australian Museum, Francis, Street, Perth, Western Australia 6000

Abstract

Gunn, S.W. and Morgan, G.J., 1992. A new species of *Pagurixus* (Crustacea: Decapoda: Paguridae) from southern Australia. *Memoirs of the Museum of Victoria* 53: 31–41.

Pagurixus handrecki sp. nov. is described from shallow inshore waters of Victoria, Tasmania, South Australia and south-western Western Australia. The species is recognisable by the lack of a distinct ventral row of setae on the ultimate segment of the antennular peduncle, the proportions and spination of the dactyli of pereopods, ornamentation of the chelipeds and live colour.

Introduction

The pagurid genus *Pagurixus* Melin was recently reviewed by McLaughlin and Haig (1984). They recognised eight species with only one, *P. jerviensis* McLaughlin and Haig, occurring in Australia. The range of that species was given as south-eastern Australia; their material examined included specimens from Sydney to Jervis Bay, New South Wales, and from Lord Howe Island. Morgan (1990) tentatively recorded *P. boninensis* (Melin) from the Kimberley coast of north-western Australia.

Examination of collections in the Museum of Victoria, Melbourne (NMV) and South Australian Museum, Adelaide (SAM) by one of us (SWG) revealed an undescribed species of south-eastern Australian *Pagurixus*. Subsequently, specimens of this species were collected (GJM) from south-western Australia and lodged in the Western Australian Museum, Perth (WAM). Additional material has been lodged at the United States National Museum of Natural History, Smithsonian Institution (USNM), the Nationaal Natuurhistorisch Museum, Leiden (RMNH) and the Muséum national d'Histoire naturelle, Paris (MNHN). For comparison, all specimens of *P. jerviensis* held in the Australian Museum, Sydney, including the holotype, were examined.

Sizes of specimens are indicated by shield length (SL). The Marine Research Group of Victoria collected many of the specimens and is abbreviated as MRGV.

Pagurixus handrecki sp. nov.

Figures 1–4

Material examined. Holotype, Victoria, southern Port Phillip Bay, 7 m, sand and algae, 1986–1990, MRGV (stn SPPS 5), NMV J20520 (male, 2.9 mm).

Paratypes. Victoria. Bass Strait, off Lakes Entrance, 36 m, 15 Jun 1987, N. Coleman, NMV J20535 (1 male, 1.8 mm); eastern Bass Strait, between Barracouta oil rig and shore, 42 m, Nov 1987, N. Coleman, NMV J16854 (1 female); Shack Bay, Venus Bay, 12 m, rocks, 4 Mar 1982, C. Larson *et al.*, NMV J20536 (1 male, 2.1 mm); South Beach Road, Somers, intertidal, 28 Jan 1983, NMV J20522 (1 female, 2.8 mm); Flinders Reef, Western Port, intertidal, NMV J20523 (6 males, 3.4–2.5 mm, 1 female, 2.7 mm); Shoreham, 1902, NMV J20541 (2 males, 2.9 mm, 2.7 mm, 1 female, 2.5 mm); West Head, Flinders, intertidal rock pool, S. Fulton, NMV J16858 (2 males, 2.9 mm, 2.8 mm); Type locality, NMV J20530 (1 female, 2.4 mm, NMV J20543, 1 male, 2.3 mm); southern Port Phillip Bay, 6 m, sand and shell, 1986–1990, MRGV (stn SPPS 11), NMV J20521 (1 female, 2.0 mm), NMV J20526 (3 males, 2.3–1.9 mm), USNM (2 males, 2.7 mm, 1.5 mm, 10 females, 2.3–1.7 mm), NMV J20537 (1 female, 2.0 mm), RMNH (1 male, 2.4 mm, 1 female, 2.3 mm); southern Port Phillip Bay, 12 m, reef and algae, 1986–1990, MRGV (stn SPPS 7), NMV J20532 (1 male, 2.5 mm), NMV J20544 (1 male, 2.9 mm, 1 female, 1.7 mm); southern Port Phillip Bay, 10 m, sand and shell, 1986–1990, MRGV (stn SPPS 10), NMV J20542 (1 male, 2.3 mm, 1 female, 2.4 mm).

Tasmania. Ninepin Point, 3 m, *Macrocystis* holdfasts, 20 Mar 1988, G.C.B. Poore and H. Lew Ton, NMV J8582 (1 male, 1.8 mm, 2 females, 2.5 mm, 2.1 mm); SW of Randalls Bay, Garden Island Bay, 4 m, red algae, sponges and bryozoans, 19 Mar 1988, G.C.B. Poore and H. Lew Ton, NMV J8714 (2 females, both 1.6 mm); Peggs Beach Coastal Reserve, 2 km W of Port Latta, 2 m, sponges and red algae, 16 Mar 1988, G.C.B. Poore and H. Lew Ton, NMV J11444 (1 ovigerous female, 2.1 mm); Bicheno, E side of Waubs Bay, 11 m, reef, red and brown algae, 23 Mar 1988, G.C.B. Poore and H. Lew Ton, NMV J20529 (1

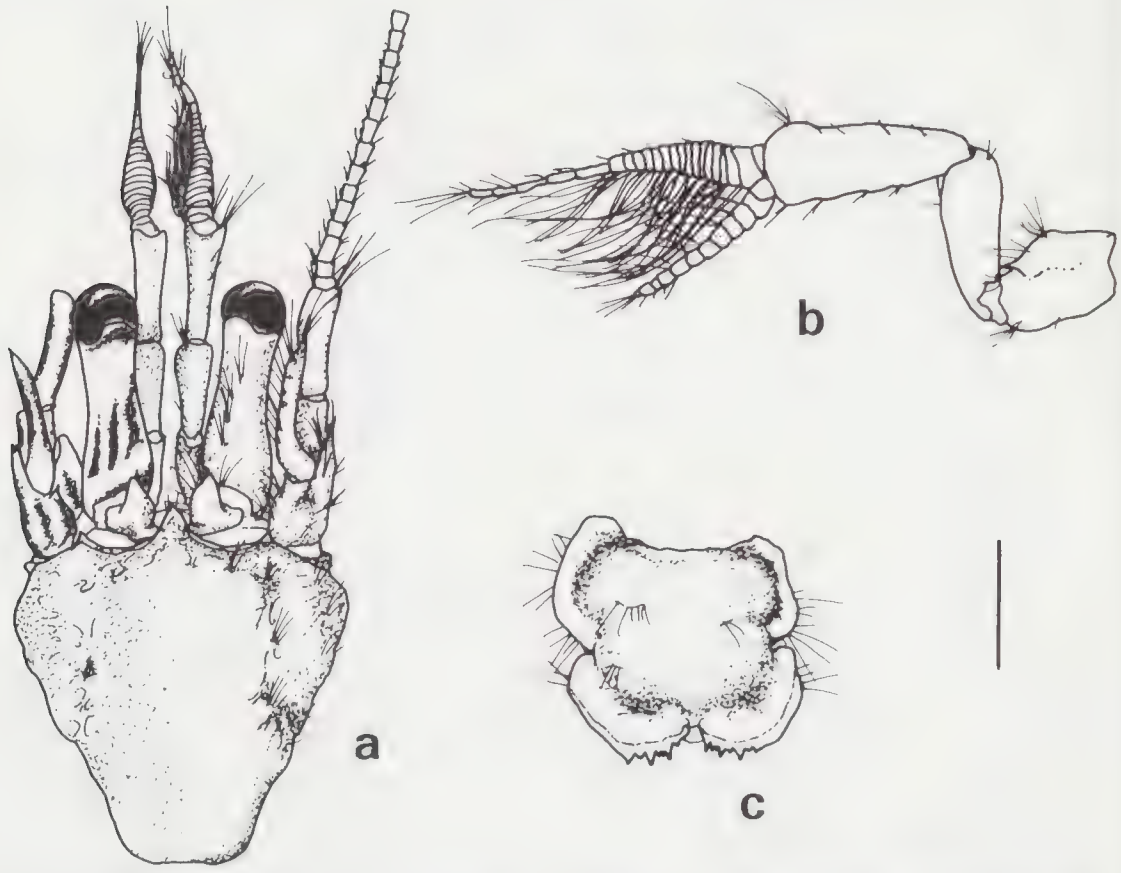


Figure 1. *Pagurixus handrecki* sp. nov., holotype male. A, dorsal view of shield and cephalic appendages, colour patterns on left side (setae omitted); B, lateral view of left antennule; C, dorsal view of telson. Scale = 1 mm (A), 0.63 mm (B), 0.5 mm (C).

male, 2.0 mm); 14 m, drift weed on sand, NMV J20547 (1 male, 2.0 mm); central Bass Strait, 9 km SSW of Three Hummock Island, 27 m, coarse sand, 2 Nov 1980, M. Gomon and G.C.B. Poore, NMV J20373 (2 males, both 2.1 mm; 3 n. mi. E of Babel Island, 40 m, 11 Oct 1984, SAM C4336 (1 male, 2.5 mm).

South Australia. Edinburgh, N of swimming pool, Yorke Peninsula, 1–5 m, SAM C4339 (1 ovigerous female, 2.1 mm); Stansbury jetty, Yorke Peninsula, 1-3 m, SAM C4340 (2 males, 2.7–2.0 mm, 1 female, 1.9 mm); Port Moorowie, Yorke Peninsula, 6 m, under rock, reef, 29 Mar 1986, SAM C4337 (1 male, 2.3 mm); Fanny Point, Boston Island, Eyre Peninsula, SAM C4338 (1 male, 2.7 mm); Kangaroo Reef off Maria Point, Boston Island, Eyre Peninsula, 3–8 m, sponge, 17 Feb 1988, SAM C4341 (1 male, 2.2 mm); SAM C4343 (1 male, 2.7 mm, 1 ovigerous female, 2.3 mm); Arno Bay jetty, Eyre Peninsula, SAM C4342 (1 male, 1.8 mm).

Western Australia. All Rottnest Island, collected by G.J. Morgan. Pocillopora Reef, 4 m, sand and rubble, 14 Jan 1991, WAM 39-91 (6 males, 1.8–1.1 mm, 12 females, 1.9–1.3 mm); Fish Hook Bay, 12 m, sand, rubble and weed, 19 Jan 1991, WAM 40-91 (2 males, 2.4 mm, 1.7 mm, 2 ovigerous females, both 2.1 mm); Little Salmon Bay, 2 m, coral and rubble, 20 Jan 1991, WAM 41-91 (1 male, 1.8 mm); Kitson Point, 6 m, coral and rubble, 23 Jan 1991, WAM 42-91 (1 male, 2.0 mm, 4 females 2.1–1.0 mm); Nancy Cove, 15 m, 16 Jan 1991, WAM 43-91 (1 ovigerous female, 1.5 mm); Nancy Cove, 9 m, rubble, 15 Jan 1991, MNHN Pg4869 (2 males, 2.1 mm, 2.0 mm, 5 females, 1.7–1.4 mm); North Point, 8 m, rubble, 22 Jan 1991, WAM 44-91 (2 males, both 1.3 mm, 4 ovigerous females, 1.6–1.4 mm); Kingston Reefs, 12 m, 21 Jan 1991, WAM 45-91 (1 male, 1.3 mm); Stark Bay, 4 m, 13 Jan 1991, WAM 46-91 (1 ovigerous female, 1.5 mm); Cathedral Rocks, 13 m, 15 Jan 1991, WAM 47-91 (2 males, 1.5 mm, 1.4 mm, 1 ovigerous female, 1.4 mm); Duck Rock, 5 m, sand and rock, 9 Jan 1991, WAM 20-91 (2 males, 2.2 mm, 1.8 mm, 4 females, 2.1–1.5 mm).

Description. Shield (fig. 1A) longer than broad; anterior margin concave; anterolateral margins

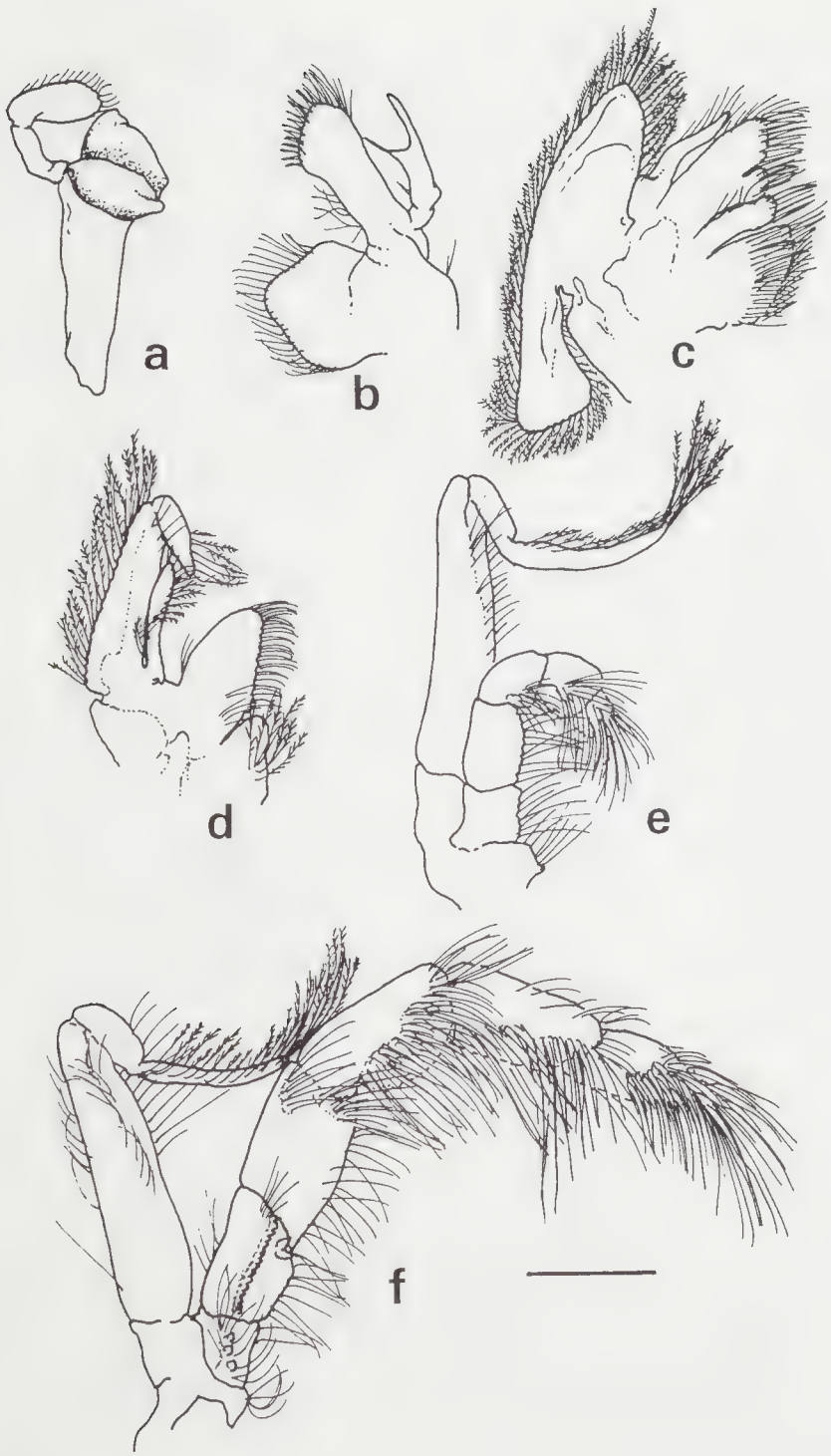


Figure 2. *Pagurixus handrecki* sp. nov., holotype male. A, C–F, mesial view of left mouthparts; B, mesial view of right mouthpart. A, mandible; B, maxillule; C, maxilla; D, first maxilliped; E, second maxilliped; F, third maxilliped. Scale = 0.5 mm.

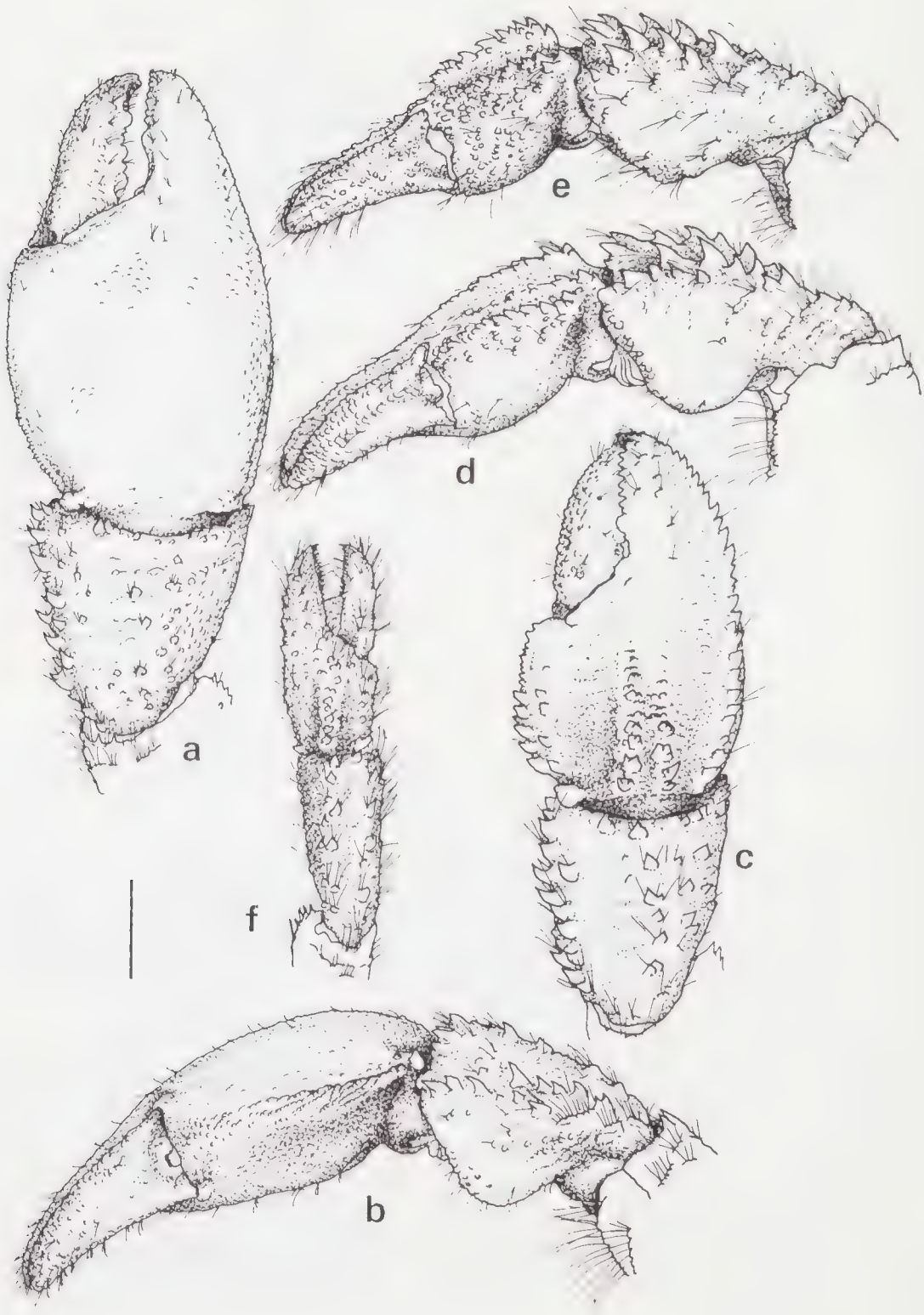

a
b
c
d
e
f

Figure 3. *Pagurixus handrecki*, sp. nov. A, B, F, holotype male; C–E, paratype females. A, dorsal view of male right chela and carpus; B, mesial view of male right chela and carpus; C, dorsal view of female right chela and carpus, SL 2.3 mm, NMV J20531; D, mesial view of female right chela and carpus (same specimen as C); E, mesial view of female right chela and carpus, SL 2.5 mm, NMV J20541; F, dorsal view of male left chela and carpus. Scale = 1 mm (A, B, F), 0.63 mm (C–E).

sloping; posterior margin truncate. Rostrum overreaching bases of ocular acicles; terminating in acute spinule. Lateral projections obtusely triangular with distinct marginal or submarginal spine.

Ocular peduncles about two-thirds length of shield, 3–4 times as long as maximum width, slightly inflated proximally and distally, dorsomesial row of tufts of setae; ocular acicles subtriangular, usually with small submarginal terminal spine, separated basally by basal width or slightly more than basal width of 1 acicle.

Antennular peduncles (fig. 1A, B) overreaching ocular peduncles by one-half to two-thirds length of ultimate segment. Ultimate segment with tuft of long setae at distal dorsolateral angle and scattered tufts of short setae on dorsal surface; ventral surface with row of 4 or 5 tufts of usually 2 short setae. Penultimate segment unarmed, with some scattered short setae. Basal segment with acute spine on lateral face distally and often spinule at distomesial angle.

Antennal peduncles shorter than antennular peduncles, overreaching ocular peduncles by about one-quarter length of ultimate segment. Fifth and fourth segments unarmed. Third segment with spine at ventrodistal margin. Second segment with distal dorsolateral angle produced and terminating in 3 or 4 spines, distal dorsomesial angle with 1 spine; segment with scattered setae. First segment with distal ventromesial angle produced with 1 small lateral spine; lateral margin bearing protuberance or spinule. Antennal acicle arcuate, terminating in small spine, mesial margin with row of long setae. Antennal flagellum moderately long, overreaching larger cheliped; articles with 4–6 short setae, mostly laterally and mesially, setae very short distally.

Mandible (fig. 2A) with at least 1 blunt cusp. Maxillule (fig. 2B) with internal lobe of endopodite well developed, bearing 1 terminal bristle; external lobe very produced, shallowly curving mesially. Maxilla (fig. 2C) with scaphognathite rather slender. First maxilliped (fig. 2D) with basal segment of exopodite slender and flagellum rather short; endopodite about two-thirds length of exopodite. Second maxilliped (fig. 2E) lacking distinguishing characters. Third maxilliped (fig. 2F) with 1, occasionally 2, accessory teeth; basis with 2–3 small teeth; merus unarmed. Sternite of third maxillipeds unarmed.

Right cheliped of males (figs 3A, B) moderately swollen, much larger than left. Dactylus slightly shorter than palm; cutting edge with large calcareous teeth for proximal two-thirds, small pectinate corneous teeth for distal third, terminating in calcareous tooth and slightly overlapped by fixed finger; dorsal surface very little elevated in midline, dorsomesial margin distinct only proximally; dorsal, mesial and ventral faces minutely granular. Palm approximately same length as carpus; dorsomesial margin clearly delimited by granular ridge for proximal two-thirds to three-quarters, becoming obsolete distally; dorsal surface minutely granular, dorsolateral margin crenulate; cutting edge of fixed finger with calcareous teeth; lateral, mesial and ventral surfaces of palm and fixed finger minutely granular, granules immediately ventral to mesial ridge often arranged in short diagonal rows. Chela with only scattered short setae. Carpus of similar length to merus, strongly inflated ventrally; dorsomesial margin with irregular row of strong spines and acute tubercles, as large distally as proximally; dorsal surface with scattered spines and acute tubercles sometimes forming very irregular row just lateral to midline, distal margin with varying number and size of spines; lateral, ventral and mesial surfaces minutely granular and with some short setae. Merus triangular in cross-section, with transverse ridges and short setae on dorsal margin; distodorsal margin usually with 1 or 2 spines, ventrolateral and ventromesial margins with row of spines or spinules and long setae. Cheliped spines usually largest on large specimens.

Right cheliped of females (figs 3C–E) considerably smaller and less massive than that of males. Dactylus subequal to palm in length, cutting edge with corneous teeth distally, calcareous proximally; dorsomesial margin moderately distinct proximally, obsolete distally, and bearing granules or acute, sometimes spinulose, tubercles; mesial face granular, with low tuberculate ridge along midline; dorsal and ventral

surfaces with scattered low protuberances. Palm distinctly shorter than carpus; dorsomesial margin clearly defined by row or rows (often elevated as a ridge) of acute or spinulose tubercles or spines, usually largest proximally; variable development of second row or ridge on dorsal surface lateral to dorsomesial ridge, sometimes slightly elevated and bearing low spines and tubercles, sometimes distinctly projecting and with pronounced spines and spinulose tubercles; surface between ridges minutely granular or with larger tubercles; dorsal surface of palm with ridge along midline bearing acute or spinulose tubercles and spines, ridge sometimes very projecting and with steep distal edge; median ridge becoming obsolete or abruptly terminating near base of fixed finger, then continuing as low elevation bearing some tubercles along finger; often second tuberculate or spinose ridge immediately lateral to median ridge, this second ridge sometimes fusing with median ridge or absent; remainder of dorsal surface of palm minutely granular or with scattered small acute and sometimes spinulose tubercles; lateral margin clearly limited by row of moderately large spines, smallest distally. Carpus similar in length to merus; dorsomesial margin with irregular row or rows of strong spines and usually second irregular row of strong spines just lateral to midline; dorsal surface between rows relatively smooth with some low granules or tubercles; distal margin with several spines; dorsolateral margin indistinct and curved, dorsolateral surface with numerous spines and acute and spinulose tubercles; ventral and mesial faces minutely granular. Merus with row of strong spines along ventrolateral margin, small spines or tubercles along ventromesial margin.

Left cheliped (fig. 3F) about three-quarters length of right, elongate, chela subrectangular in dorsal view, fingers spoon-shaped. Dactylus slightly longer than palm; cutting edge with row of narrow corneous teeth, terminating in corneous claw; dorsal surface punctate with scattered low protuberances or tubercles sometimes in irregular row along midline and scattered setae; dorsomesial margin poorly delimited, mesial face with some low protuberances or tubercles. Palm about one-half length of carpus; dorsal midline elevated, sometimes strongly so, armed with row of acute tubercles and spines, these largest proximally, and extending onto fixed finger as row of small tubercles; dorsomesial margin with row of small spines or tubercles, less prominent than median row; dorsolateral surface minutely granular or spinulose, strongly sloping to margin with irregular row of small tubercles; ventral surface with scattered tubercles or protuberances. Chela with sparse tufts of long setae. Carpus slightly shorter than merus; dorsomesial and dorsolateral margins each with row of stong spines and tubercles, usually smaller proximally; distodorsal margin with 1 or more strong spines; lateral, mesial and ventral surfaces with low tubercles and protuberances at bases of tufts of long setae; ventrolateral margin with row of small tubercles or spines distally. Merus with low protuberances at bases of tufts of short setae on dorsal margin; lateral and mesial faces with low tubercles and granules; ventromesial margin with some spinules and long setae, ventrolateral margin with row of strong spines.

Second (fig. 4A) and third (figs 4B, C) pereopods generally similar and not overreaching large cheliped. Dactyli subequal to propodi in length; slightly curved ventrally in lateral view, slightly twisted in dorsal view; ventral margins with row of 8 to 12 (rarely up to 14) strong corneous spines. Propodi longer than carpi, slightly more elongate on second than on third pereopods; ventral margins with 4 to 6 corneous spines or spinules. Carpi shorter than meri; dorsal surfaces with low protuberances at bases of setal tufts; distodorsal angles with spine (sometimes small). Meri longer on second than on third pereopods; with low protuberances at bases of setae on dorsal and ventral margins; second pereopods with spine at distolateral angles, sometimes with additional spine or spinule proximally. Ischium much longer on third than on second pereopods. Pereopods bearing sparse tufts of rather long setae. Sternite of third pereopods (fig. 4D) with anterior lobe subrectangular, anterior margin with long setae.

Females with paired gonopores.

Telson (fig. 1C) with posterior lobes separated by strong median cleft; terminal margins approximately straight or shallowly oblique, left and right posterior lobes each with 2 to 4 moderately stong terminal spines and 2 to 6 spinules; lateral margins unarmed.

Colour (*in life*) Shield (fig. 1A) predominantly cream, often with darker areas or mottling, with scattered red chromatophores; often 2 red spots lateral to midline. Ocular peduncles cream or white with short longitudinal red or red-brown stripes subproximally and red annuli distally and proximally. Corneas with silvery sheen. Ocular acicles white with red chromatophores. Antennular peduncles with distal segment

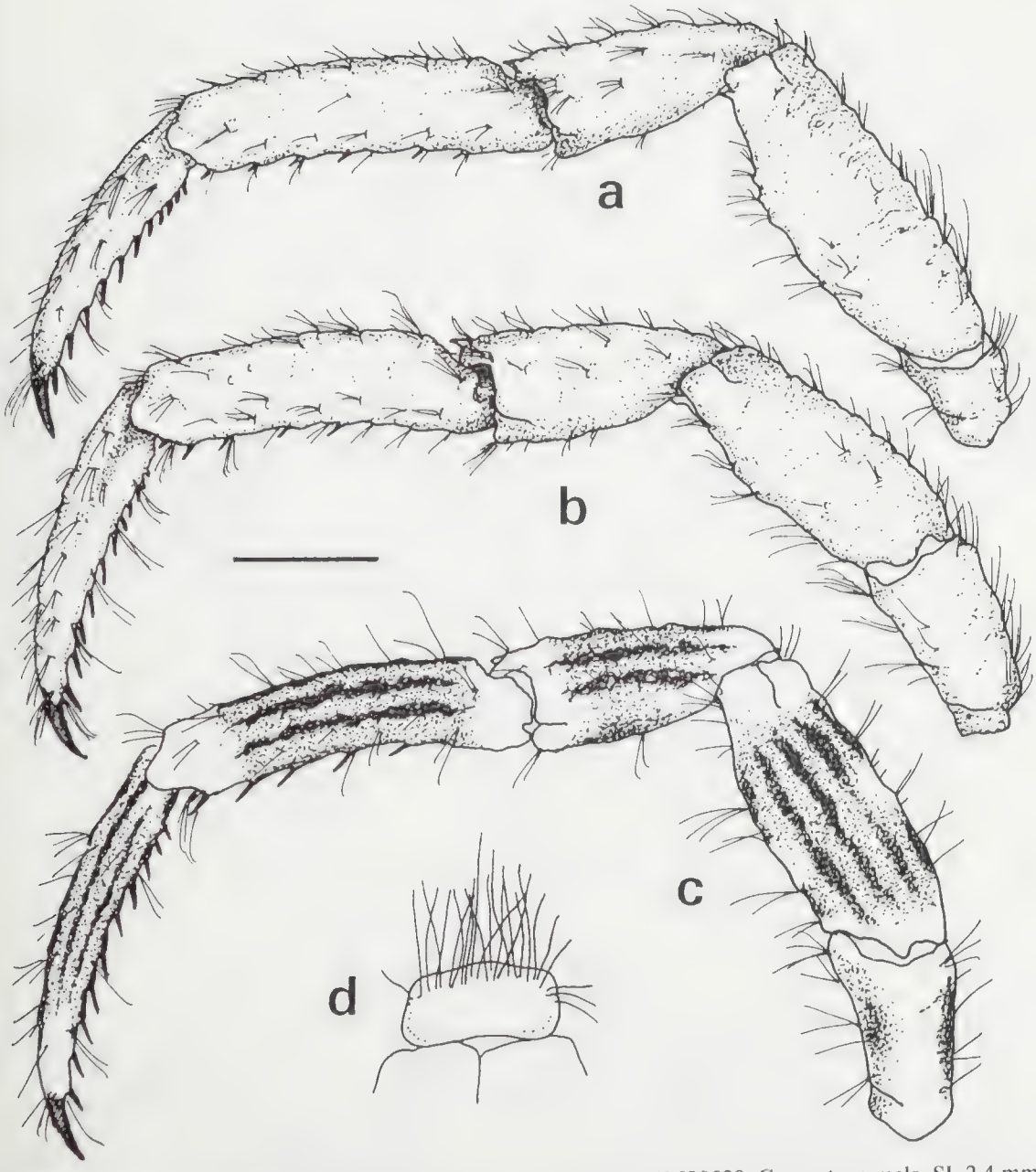


Figure 4. *Pagurixus handrecki*, sp. nov. A, B, D, holotype male NMV J20520; C, paratype male, SL 2.4 mm, WAM 40-91. A, lateral view of second pereopod; B, lateral view of third pereopod; C, lateral view of third pereopod showing colour pattern; D, anterior lobe of sternite of third pereopods. Scale = 1 mm (A, B), 0.8 mm (C), 0.5 mm (D).

orange for proximal quarter to third, purple distally; subdistal segment orange. Flagella orange. Antennal peduncles cream with some red or red-brown stripes and patches on most segments and acicles. Flagella pale brown with some segments paler and with white distomesial spots, these spotted segments becoming more spaced distally. Right cheliped with dactylus and fixed finger cream, palm with pink or grey tinge; often some red dots on propodus especially along proximal margin and at articulation with dactylus; carpus and merus darker, mottled with pale

Table 1. Characters distinguishing *Pagurixus handrecki* sp. nov. and *P. jerviensis* McLaughlin and Haig.

	P. handrecki	*P. jerviensis*
Dactyli of pereopods 2 and 3	Subequal in length to propodus (fig. 4A–C)	Shorter than propodus (fig. 6A, B)
	8–14 ventral spines (fig. 4A–C)	7–10 ventral spines (fig. 6A, B)
Palm of right cheliped of male	Distinct mesial ridge for two-thirds to three-quarters palm length (fig. 3B)	Mesial ridge only proximally (fig. 5B)
Carpus of right cheliped of male	Several variable spines on distal margin, usually large dorsomesial spines (fig. 3A)	Few spinules or tubercles on distal margin, dorsomesial spines poorly developed (fig. 5A)
Palm of right cheliped of female	Dorsomesial ridge and ridge lateral to this bearing strong spines or tubercles and not defining flattened facet (fig. 3C–E)	Dorsomesial ridge and ridge lateral to this poorly spinose and defining rather smooth dorsomesial facet (fig. 5C, D)
	Median ridge strongly produced, usually strongly spinose (fig. 3C)	Median ridge more weakly produced, usually weakly spinose (fig. 5C)
Carpus of right cheliped of female	Irregular row of large spines lateral to midline (fig. 3C)	Low spinules and tubercles lateral to midline (fig. 5C)
Palm of left cheliped	Median ridge more produced than dorsomesial ridge (fig. 3F)	Median and dorsomesial ridges subequal (fig. 5E)
Ocular peduncles	Length 3–4 times maximum width (fig. 1A)	Length 2–3 times maximum width (McLaughlin and Haig, 1984: fig. 6a)
Live colour	Dark reddish longitudinal stripes on ocular peduncles and pereopods (figs 1A, 4C)	Diffuse dark bands on pereopods

brown, 3 or 4 diffuse red-brown longitudinal stripes dorsally and laterally on merus and more faintly on carpus proximally. Left cheliped darker than right; fingers with cream tips, remainder medium brown; palm pale brown, median ridge darker; carpus and merus with distinct longitudinal red-brown stripes. Second and third pereopods (fig. 4C) with distinct longitudinal red or red-brown stripes on paler pink background; dactylus cream distally, other segments cream distally and proximally. Tailfan white with red chromatophores. Females generally darker than males, with colour pattern of both chelipeds similar.

Etymology. Named after Mr Clarrie P. Handreck, secretary of the Marine Research Group of Victoria, in recognition of his considerable contribution to the knowledge of the coastal fauna of Victoria.

Distribution. South-eastern Australia from Lakes Entrance, Victoria, west to South Australia and southwestern Western Australia, including Tasmania. Intertidal to 42 m.

Remarks. Pagurixus handrecki is the third species of the genus recorded from Australian waters. Table 1 lists characters that distinguish *P. handrecki* from *P. jerviensis* which ranges from Tuggerah Lakes north of Sydney south to Mallacoota in eastern Victoria. On the basis of available specimens, it appears that *P. handrecki* is a smaller species than *P. jerviensis*. The largest specimen of the former has a shield length of 3.4 mm, and most specimens are considerably

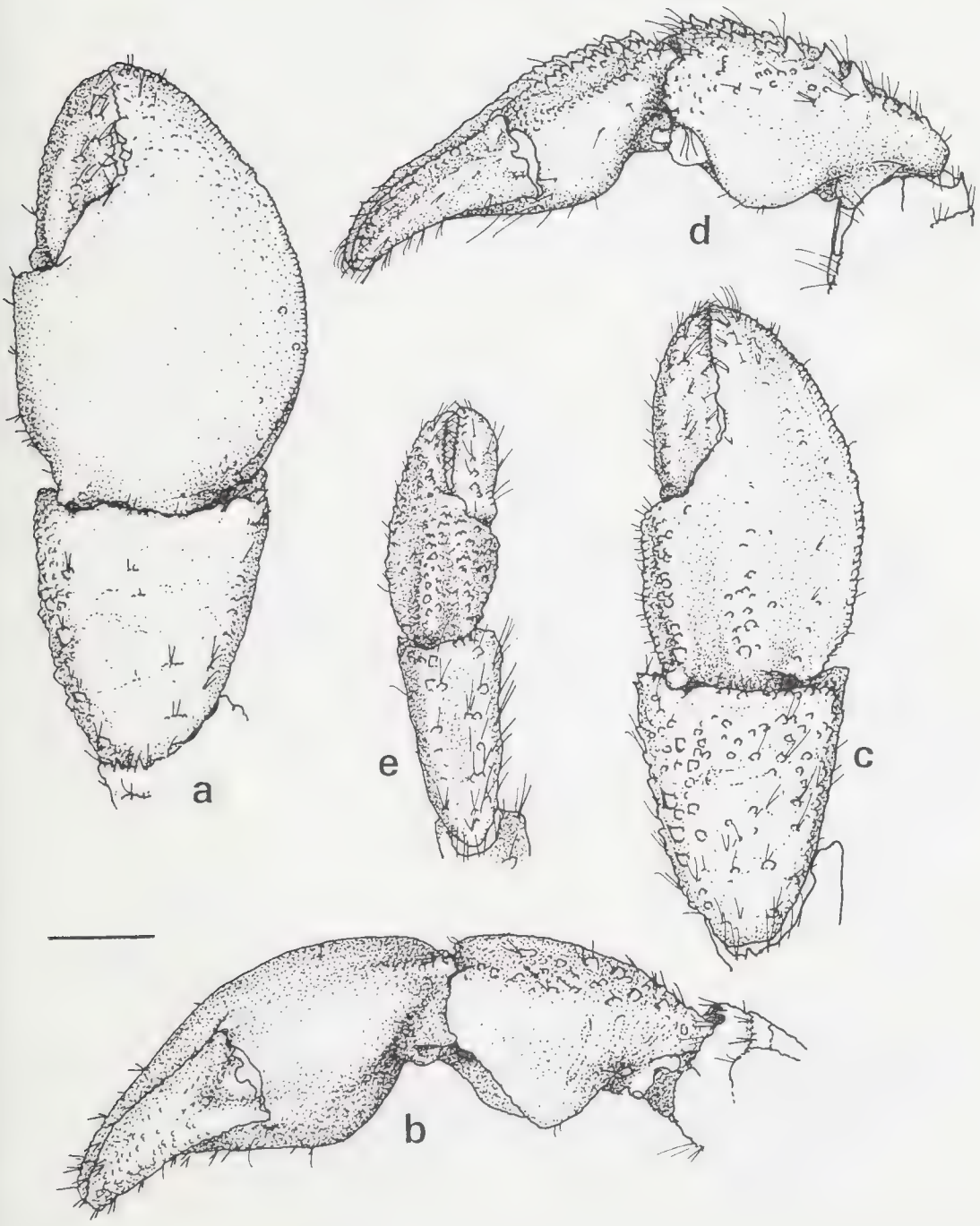


Figure 5. *Pagurixus jerviensis* McLaughlin and Haig. A, B, E, holotype male, AM P33836; C, D, female, SL 3.4 mm, AM P7152. A, dorsal view of male right chela and carpus; B, mesial view of male right chela and carpus; C, dorsal view of female right chela and carpus; D, mesial view of female right chela and carpus; E, dorsal view of male left chela and carpus. Scale = 1 mm.

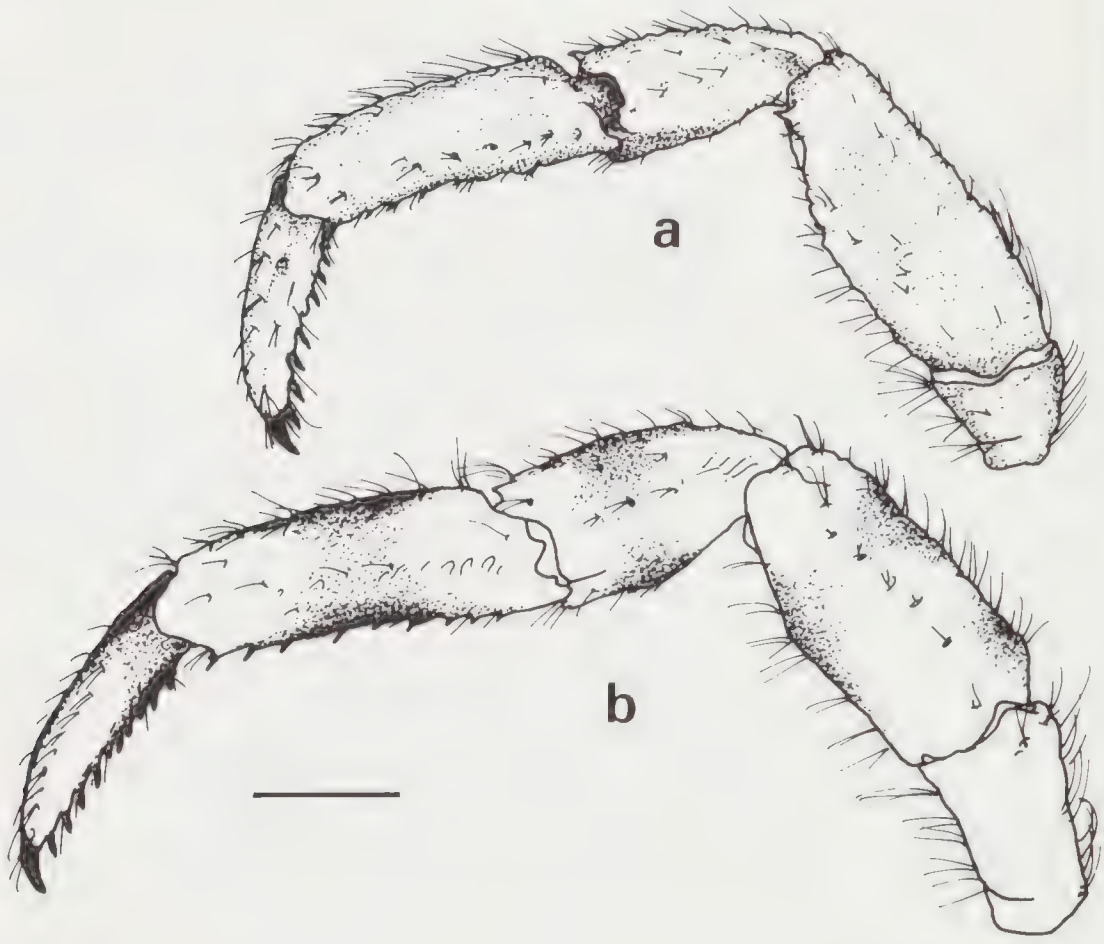


Figure 6. *Pagurixus jerviensis* McLaughlin and Haig. A, lateral view of second pereopod of holotype; B, lateral view of third pereopod showing colour pattern (preserved) of male, SL 3.2 mm, AM P7152. Scale = 1 mm.

smaller, while the latter grows to at least 4.3 mm. In both species, adult males are larger than females.

McLaughlin and Haig (1984) divided *Pagurixus* into two groups on the basis of presence or absence of a distinct row or rows of setae on the ventral margin of the ultimate segment of the antennular peduncles. *Pagurixus handrecki* has several short setae or tufts of two setae along this margin and presumably falls into the group lacking distinct rows. The condition of *P. handrecki* appears to be closest to that of *P. anceps* (Forest). The ventral surface of the antennular segment in *P. jerviensis* was described by McLaughlin and Haig as "naked" but in fact there are 3 to 5 short setae present on most specimens, including the holotype. The absence of distinct setal rows distinguishes *P. handrecki* from *P. boninensis* (Melin), *P. festinus* McLaughlin and Haig, *P. maorus* (Nobili) and *P. tweediei* (Forest).

Descriptions and illustrations by Forest (1956) and McLaughlin and Haig (1984) indicate that all congeners have stouter ocular peduncles than those of *P. handrecki,* the closest species in this respect being *P. anceps* and *P. laevimanus* (Ortmann). In combination, the ornamentation of the chelipeds and the shape and spination of the dactyli of second and third pereopods also separate *P. handrecki* from other species. Colour was noted for only four species by McLaughlin and Haig (1984) and then usually for preserved material. Of these, *P. maorus* is most similar to *P. handrecki* in colour, both having reddish longitudinal stripes on the pereopods, but in the former, the stripes are more numerous. The colours of *P. handrecki* are dis-

tinctly different from the other three species: *P. anceps, P. hectori* (Filhol) and *P. jerviensis.*

Pagurixus *handrecki* is similar in size to *P. tweediei, P. maorus* and *P. boninensis*, is smaller than *P. hectori* and *P. jerviensis* and larger than *P. anceps, P. laevimanus* and *P. festinus* (Forest, 1956; McLaughlin and Haig, 1984). Females of *P. handrecki* were ovigerous at shield lengths as small as 1.3 mm. Of 34 females collected from Rottnest Island, Western Australia, in January 1991, 28 (82%) were ovigerous.

Acknowledgements

We thank the staff of the museums who assisted by making material available on loan: Mr Robin Wilson (NMV), Ms Karen Gowlett-Holmes (SAM) and Dr Penny Berents (AM). Dr Gary Poore (NMV) and Dr Patsy McLaughlin (Shannon Point Marine Center) offered constructive criticism and advice during the study and on the manuscript. The Marine Research Group of Victoria provided many of the Victorian specimens.

References

Forest, J., 1956. La faune des îles Cocos-Keelings Paguridea. *Bulletin of the Raffles Museum, Singapore* 27: 45–55.

McLaughlin, P.A. and Haig, J. 1984. A review of *Pagurixus* (Decapoda, Anomura, Paguridae) and descriptions of new species. *Crustaceana* 47 (2): 121–148.

Morgan, G.J., 1990. A collection of Thalassinidea, Anomura and Brachyura (Crustacea: Decapoda) from the Kimberley Region of northwestern Australia. *Zoologische Verhandelingen* 265: 1–90.

Memoirs of the Museum of Victoria 53(1): 43–99 (1992)

REVISION OF *PYLOPAGURUS* AND *TOMOPAGURUS* (CRUSTACEA: DECAPODA: PAGURIDAE), WITH THE DESCRIPTIONS OF NEW GENERA AND SPECIES.

PART IV.
LOPHOPAGURUS McLAUGHLIN AND *AUSTRALEREMUS* McLAUGHLIN

By Patsy A. McLaughlin[1] and S. W. Gunn[2]

[1] Shannon Point Marine Center, 1900 Shannon Point Road, Anacortes, Washington 98221-4042, USA
[2] Department of Crustacea, Museum of Victoria, Swanston Street, Melbourne, Victoria 3000, Australia

Abstract

McLaughlin, P.A. and Gunn, S.W., 1992. Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with descriptions of new genera and species. Part IV. *Lophopagurus* McLaughlin and *Australeremus* McLaughlin. *Memoirs of the Museum of Victoria* 53: 43–99.

In this fourth of a six-part series, the genera *Lophopagurus*, and *Australeremus* as herein emended, and their respective species are redescribed and illustrated. The identity of *Lophopagurus thompsoni* (Filhol) is defined by lectotype selection and a species heretofore confounded with it is described as *Lophopagurus foresti* sp. nov. One additional new species of *Lophopagurus*, *L. nodulosus* sp. nov. is also described. The assignment of *Pylopagurus cristatus* (H. Milne Edwards) to *Lophopagurus* is refuted; it is reassigned to *Australeremus*. The questionable assignment of *Pylopagurus kirkii* (Filhol) to *Australeremus* is confirmed. *Pagurus triserratus* (Ortmann) has been determined to be the senior subjective synonym of *Pylopagurus serpulophilus* Miyake. It and *Pylopagurus stewarti* (Filhol) are also assigned to *Australeremus* and two new species, *A. laurentae* sp. nov. and *A. eltaninae* sp. nov., are described in this genus. Keys to the species are presented for both genera.

Contents

Introduction 43
Materials 44
Lophopagurus 45
Key to species of *Lophopagurus* 46
Lophopagurus thompsoni (Filhol) 47
Lophopagurus foresti sp. nov. 52
Lophopagurus nodulosus sp. nov. 55
Lophopagurus crenatus (Borradaile) 58
Lophopagurus lacertosus (Henderson) 61
Lophopagurus nanus (Henderson) 65
Australeremus 68
Key to the species of *Australeremus* 70
Australeremus cookii (Filhol) 70
Australeremus laurentae sp. nov. 74
Australeremus cristatus (H. Milne Edwards) 77
Australeremus kirkii (Filhol) 80
Australeremus stewarti (Filhol) 83
Australeremus triserratus (Ortmann) 87
Australeremus eltaninae sp. nov. 92
Acknowledgements 94
References 95

Introduction

More than 15 years ago, Jacques Forest and Michèle de Saint Laurent (Muséum National d'Histoire Naturelle, Paris) began a review and revision of the taxonomy of the hermit crabs of New Zealand (R.L.C. Pilgrim, pers. comm.; Schembri and McLay, 1983; J. Forest, J. Yaldwyn, pers. comms.). The efforts of these

well known carcinologists initially were focused on the Coenobitoidea; however, they recognized the need for, and began, revisionary work in the Paguroidea as well. It was, in part, through their help that one of us (PMcL) was able to make inaugural subdivisions of the heterogeneous genus *Pylopagurus*.

In Part I of what is to be a six part revision, *Pylopagurus* Milne Edwards and Bouvier, 1891, was restricted to species typified by *P. discoidalis* (A. Milne Edwards, 1880); the remaining species assigned to *Pylopagurus* by A. Milne Edwards and Bouvier (1893) were transferred to new genera (McLaughlin, 1981a). Part II dealt with the western Atlantic-Eastern Pacific genera *Rhodochirus* McLaughlin and *Phimochirus* McLaughlin (McLaughlin, 1981b), and Part III presented diagnoses and descriptions of new species of the Atlantic genus *Agaricochirus* McLaughlin and the Pacific genera *Enallopagurus* McLaughlin and *Enallopaguropsis* McLaughlin (McLaughlin, 1982). Part IV reports on species assigned to *Lophopagurus* McLaughlin and *Australeremus* McLaughlin, together with descriptions of four new species.

Among the taxa characterized by 11 pairs of phyllobranch gills and females with paired 1st pleopods modified as gonopods, *Lophopagurus* is distinctive in the form of the left chelae of its members. There is little variation in the configuration of the chela among the assigned species, all of which apparently are endemic to the waters of New Zealand and southern Australia. However, the genus can be divided into two distinct, and presumably evolutionary sister-groups on the basis of the similarity or dissimilarity of the dactyls and occasionally also the propodi of the ambulatory legs. Although such variations have not been observed in other pylopagurid-like genera, somewhat analogous dissimilarities between left third and the remaining right and left pereopods have been reported in certain species of *Pylopaguropsis*, a genus in which female gonopods are also present but one immediately distinguishable from pylopagurid-like genera by the presence of 13 pairs of trichobranchiate gills (McLaughlin and Haig, 1989).

When originally diagnosed (McLaughlin, 1981a), *Australeremus* was represented only by its type species, *Eupagurus cookii* Filhol, 1883, and with the questionably assignment of *Eupagurus kirkii* Filhol, 1883. However, new data have shown that the diagnosis of *Australeremus* requires emendation, and that at least one of its representatives occurs in the more northern waters of Japan and China. The uncertain assignment of *E. kirkii* to the genus is confirmed.

Pagurus cristatus H. Milne Edwards, 1836, which had been questionably assigned to *Lophopagurus* by McLaughlin (1981a), is now recognized as properly belonging to *Australeremus*. Two of the species first included by McLaughlin (1981a) in *Pylopagurus* sensu stricto, i.e., *P. stewarti* (Filhol) and *P. serpulophilus* Miyake, must now be transferred to *Australeremus*. Miyake's species is believed to be a junior subjective synonym of *Eupagurus triserratus* Ortmann. Additionally, two new species of *Australeremus* are described from New Zealand waters.

Identification of species of *Lophopagurus* and *Australeremus* is complicated by the high degree of intrageneric similarities exhibited by their respective taxa. Moreover, species of both genera exhibit considerable intraspecific variation, particularly in the strength of the armature of the right cheliped. Additionally, characters such as length-width ratios and the development of spines on the segments of the pereopods vary with specimen size, geographic distribution and/or habitat. In contrast, colour patterns frequently appear to be duplicated. Keys to the genera have been developed using relatively stable characters and do provide assistance in species recognition. However, it is strongly recommended that the species descriptions be referred to for all but the most "classic" representatives.

Materials

The material for this study came initially from the United States Antarctic Program (USARP), through the auspices of the Smithsonian Oceanographic Sorting Center (SOSC). This material has been augmented by specimens from the collections of the Australian Museum, Sydney (AM), California Academy of Sciences, San Francisco (CAS), Canterbury Museum, Christchurch (CMC), Musée de Zoologie, Université de Strasbourg (MZUS), Muséum National d'Histoire Naturelle, Paris (MNHN), Museum of Victoria, Melbourne (NMV), New Zealand Department of Conservation (NZDC), New Zealand Oceanographic Institute, Wellington (NZOI), National Museum of Natural History, Smithsonian Institution (USNM), National Museum of New Zealand, Wellington (NMNZ), Nationaal Natuurhistorisch Museum, formerly Rijksmuseum van Natuurlijke Historie, Leiden

(RMNH), Naturhistoriska Riksmuseet, Stockholm (NHRM), Portobello Marine Laboratory, University of Otago, Dunedin (PML), The Natural History Museum, formerly British Museum (Natural History), London (BMNH), and Zoologiska Museet, Uppsala Universitet, Uppsala (ZMUU). Primary type specimens (holotypes and paratypes) from USARP collections are deposited in the National Museum of Natural History; when available, supplemental materials have been distributed among the aforementioned museums. All other specimens have been returned to their repositories of origin or deposited in one or more of the aforementioned institutions. As much as possible institutional abbreviations have been taken from the Standard Symbolic Codes for Institutional Resource Collections . . . (Leviton et al., 1985). A single measurement, shield length (SL) provides an indication of specimen size.

Lophopagurus McLaughlin, 1981

Pylopagurus. — Forest and de Saint Laurent, 1967: 145 (in part), not *Pylopagurus* Milne Edwards and Bouvier, 1891.

Lophopagurus McLaughlin, 1981a: 3 (type species, by original designation: *Eupagurus thompsoni* Filhol, 1885a. Gender masculine.)

Diagnosis. Eleven pairs of phyllobranch gills. Ocular acicles narrowly triangular, with strong submarginal spine, and rarely accessory spinule; separated basally by slightly less to considerably more than basal width of 1 acicle. Sternite of 3rd

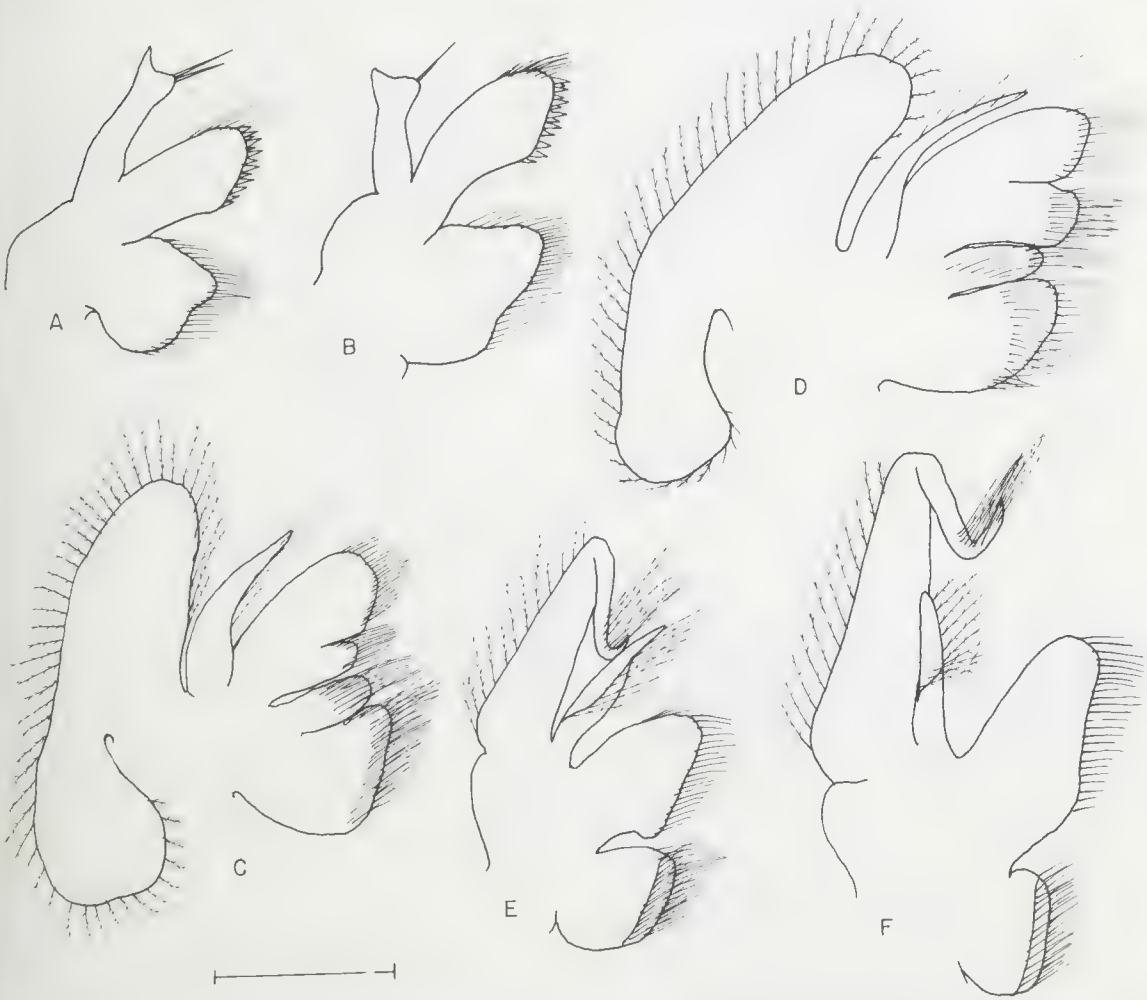


Figure 1. *Lophopagurus*. A, C, E, *L. foresti* sp. nov., A, maxillule; C, maxilla; E, first maxilliped. B, D, F, *L. nanus* (Henderson), B, maxillule; D, maxilla, F, first maxilliped. Scale = 1.0 mm (A, C, E) and 0.5 mm (B, D, F).

maxillipeds usually unarmed. Basal antennular segment with prominent lateral spine and with ventrodistal margin produced into elongate, slender lobe. Maxillule (Fig. 1A, B) with external lobe well developed, not recurved, internal lobe with 1 or 2 terminal bristles. Maxilla (C, D) with proximal lobe of scaphognathite not appreciably broadened. First maxilliped (Fig. 1E, F) with slender exopod. Third maxilliped with well developed crista dentata and prominent accessory tooth; merus sometimes with spine at dorsodistal margin.

Right cheliped with chela longer than broad; angle of propodal-carpal articulation 0°–15° from horizontal plane; dorsolateral margin of palm curved, dorsomesial margin depressed, dorsal surface with straight or concave dorsomesial component (Fig. 2B, 6B), delineated by row(s) of spines or tubercles, remaining dorsal surface with 1 or 2 narrow to moderately broad, tuberculate or spinose ridges. Left cheliped with chela broadly triangular in cross-section and dorsal view; dorsolateral margin depressed, dorsal midline elevated into prominent spinose or tuberculate keel or crest; propodal-carpal articulation 0°–25° from horizontal plane. Dactyls of ambulatory legs with lateral faces variable (rounded, flattened, marked by prominent longitudinal sulci, slightly or conspicuously concave). Sternite of 3rd pereopods with anterior projection subsemicircular to subrectangular, occasionally with 1 or 2 marginal spines. Fourth pereopods with propodal rasp consisting of single row of corneous scales; dactyl usually with small to moderately well developed preungual process at base of claw. Pereopodal bases and coxae often with dense tufts of long setae.

Abdomen typically flexed. Uropods asymmetrical. Telson with transverse suture; posterior lobes symmetrical or slightly asymmetrical, terminal margins straight, oblique or rounded, armed with numerous small to moderately strong spines, lateral margins denticulate, spinulose or spinose. Males without paired pleopods, with 3 unpaired, unequally biramous left pleopods. Females with paired 1st pleopods modified as gonopods, with 4 unpaired biramous left pleopods, 2nd–4th with both rami well developed, 5th with endopod reduced.

Distribution. New Zealand and south-eastern Australia, subtidal to 840 m.

Etymology. Lophopagurus is from the Greek *lophos*, the crest, and *pagouros* a crab, and refers to the crested left chela characteristic of this genus.

Remarks. McLaughlin (1981a) tentatively assigned *Pylopagurus cristatus* (H. Milne Edwards) to *Lophopagurus* on the basis of a photograph graciously provided by J. Forest and M. de Saint Laurent. During the course of the present study, we have had the opportunity to examine representatives of this taxon and have found that it is not correctly assignable to *Lophopagurus*. It is herein transferred to *Australeremus*.

As previously mentioned, species of *Lophopagurus* can be divided into two distinct, and seemingly evolutionary sister-groups. The first, and presumably ancestral group, which includes *L. lacertosus* (Henderson), *L. crenatus* (Borradaile), and *L. nanus* (Henderson), exhibits little if any difference in the morphological structure of the dactyls of the pereopods (rounded, flattened, with or without longitudinal sulci). The second, and apparently divergent group, which includes *L. thompsoni*, *L. foresti* sp. nov., and *L. nodulosus* sp. nov., manifests substantial morphological differences between the dactyl of the 3rd left pereopod (markedly broader and conspicuously concave) and the dactyls of the remaining ambulatory legs. Frequently the dorsal surface of the propodus of the left 3rd also is flattened and the lateral face somewhat concave. Nonetheless, patterns of routine variation such as the armature of these pereopods are similar between species of each group. For example, in the first group, the armature of the carpi varies from a complete row of dorsal spines on the carpus of each pereopod to a complete row only on the right 2nd in *L. lacertosus*. A comparable pattern is seen in *L. thompsoni*, a member of the second group.

Key to species of *Lophopagurus*

1. Carpi of 2nd (at least right) and often also 3rd pereopods each with row of spines posterior to spine at dorsodistal angle 2
— Carpi of 2nd and 3rd pereopods without row of spines posterior to spine at dorsodistal angle [2nd occasionally with 1 (rarely 2) posterodorsal spine(s)] 4
2. Dactyls and propodi of left 2nd and 3rd pereopods distinctly different (in

lateral view, segments of 3rd appreciably shorter and broader, lateral face of dactyl conspicuously concave) ..... *L. thompsoni*

— Dactyls of left 2nd and 3rd pereopods not distinctly different (in lateral view, segments of 3rd not appreciably shorter and broader, lateral face of dactyl not conspicuously concave) 3

3. Dorsal surface of dactyl and fixed finger of right chela with distinct small spines, spinules, or tubercles ..... *L. lacertosus*

— Dorsal surface of dactyl and fixed finger of right chela each with row of large, partially coalesced tubercles ..... *L. crenatus*

4. Lateral face of dactyl of left 3rd pereopod flat or rounded (with or without longitudinal sulcus) ..... *L. nanus*

— Lateral face of dactyl of left 3rd pereopod concave 5

5. Dorsal surface of palm of right chela with spinules or small tubercles; dorsolateral surface of palm of left chela spinulose or tuberculate ... . *L. foresti*

— Dorsal surface of palm of right chela with large nodule-like tubercles; dorsolateral surface of palm of left chela unarmed ..... *L. nodulosus*

Lophopagurus thompsoni (Filhol, 1885) s.s.

Figure 2

Eupagurus thompsoni Filhol, 1885a: 33 (in part). — 1885b: 423 (in part), pl. 51 fig. 6 (? in part), not fig. 7, see remarks. — Alcock, 1905: 176 (in part), see remarks. — McLaughlin, 1981a: 3 (in part), see remarks.

Not *Pagurus thompsoni* Bell, 1851: 372, unnumbered figure (= *Pagurus bubescens* Krøyer).

Eupagurus thomsoni. — Thomson, 1898: 183 (in part), see remarks.

? *Eupagurus thompsoni*. — Thompson, 1930: 270, see remarks.

Pagurus thompsoni. — Gordan, 1956: 336 (in part, see remarks). — Forest, 1961: 223.

Pagurus thomsoni. — Forest, 1961: 223.

Pagurus lacertosus. — Forest, 1961: 223.

Not *Pagurus lacertosus* (Henderson), see remarks.

Pylopagurus thompsoni. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 3 (in part), see remarks.

Pylopagurus sp. "mauve antenna 1". — Probert et al., 1979: 381 (list), 385.

Lophopagurus thompsoni. — McLaughlin, 1981a: 3 (by implication) (in part), see remarks.

Pagurus n. sp. (aff. *thomsoni*). — Rainer, 1981: 37.

Lophopagurus "thompsoni". — Schembri, 1982: 870, fig. 9. — Schembri and McLay, 1983: 30, figs 8a, b. — Probert and Wilson, 1984: 389 (list). — Schembri, 1988: 93. — Taylor et al., 1989: 1064.

Type material. Lectotype (herein designated): Cook Strait, New Zealand, MNHN (female syntype, total length = 14 mm, not examined).

Other material. New Zealand: RV *Tangaroa*, NZOI stn R94 (37°37.9′S, 176°27.0′E), 44–47 m, 21 Jan 1979, NMNZ Cr7414 (4 males, 3.8–5.1 mm). RV *Acheron* stn BS 531 (40°52′S, 172°04′E), 64 m, 10 Mar 1976, NMNZ Cr8242 (2 males, 3.0, 6.4 mm). RV *Acheron* stn BS 514 (40°57.5′S, 174°01.5′E), 29 m, 5 Mar 1976, NMNZ Cr8329 (1 male, 7.4 mm). RV *Acheron* stn BS 542 (41°08′S, 174°33.5′E), 282–293 m, 12 Mar 1976, NMNZ Cr7413 (7 males, 4 females, 3.6–9.1 mm). USNS *Eltanin* stn 25/368 (43°16′S, 175°23′ E), 84 m, 19 Nov 1966, USNM 244449 (3 males, 1 female, 2 ovigerous females, 3.8–6.5 mm). USNS *Eltanin* stn 25/369 (43°17′S, 175°23′E), 95 m, 19 Nov 1966, NHRM 16678, RMNH D 40428 (2 males, 1 female, 1 ovigerous female, 5.0–7.1 mm). USNS *Eltanin* stn 25/370 (43°22′S, 175°20′E), 95 m, 19 Nov 1966, USNM 244448 (1 ovigerous female, 6.3 mm). Walls of Pegasus Canyon (43°25′S, 173°26′E) 183 m, 21 Feb 1979, NMNZ Cr4914 (2 males, 1 female, 1 ovigerous female, SL 5.1–7.7 mm). USNS *Eltanin* stn 23/1709 (43°31′S, 176°10′W), 143–183 m, 24 May 1966, USNM 244447 (1 male, 5.0 mm). Kaikoura (3 mi off shore), 30–60 m, 24 Jan 1967, NMNZ Cr3863 (10 males, 17 females, 4.1–10.6). Bay-mouth Bar, Deep Bay, Tory Channel, 3 m, 10 Oct 1989, NZCD Cr19 (1 male, 2 ovigerous females, 4.9–8.4 mm). RV *Tangaroa* NZOI stn B 556, SE Banks Peninsula (44°00.0′S, 173°47.5′E), 179 m, 6 Oct 1962 (1 male, 1 ovigerous female, 7.4, 8.4 mm). Port Chalmers, ZMUU, (1 male, 6.8 mm).

Redescription. Shield length equal to width or slightly longer than broad; anterior margin between rostrum and lateral projections concave; posterior margin truncate; dorsal surface with few scattered tufts of setae. Rostrum triangular, acute, usually without terminal spinule. Lateral projections broadly rounded, with small marginal or submarginal spine.

Ocular peduncles ½–⅔ length of shield; dorsal surface with tuft of stiff setae at base of slightly inflated cornea. Ocular acicles acutely and narrowly triangular, with small submarginal spine; separated basally by slightly less to slightly more than basal width of 1 acicle.

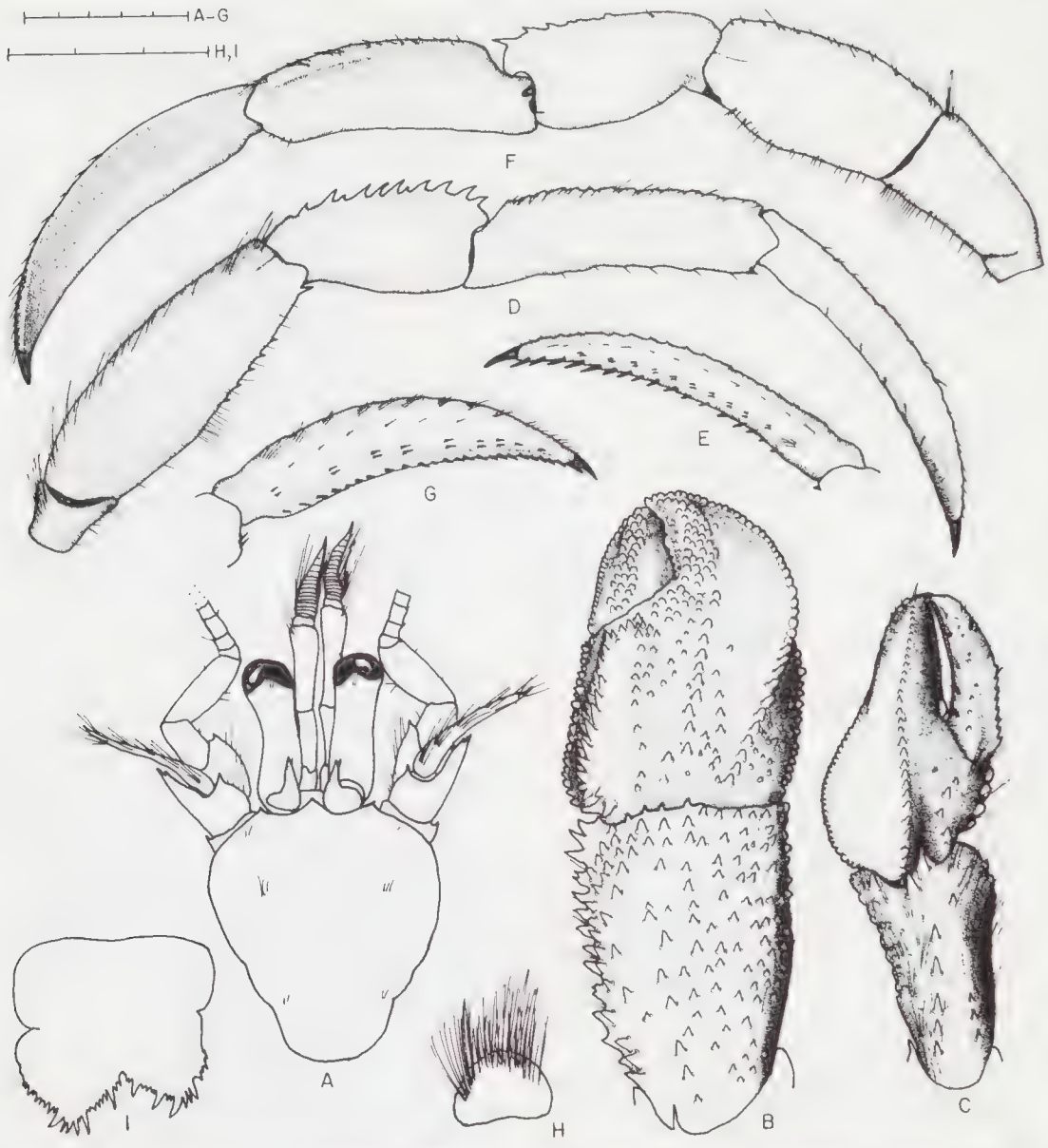


Figure 2. *Lophopagurus thompsoni* (Filhol), male from Pegasus Canyon, New Zealand, NMNZ Cr4914. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, dactyl of right 2nd pereopod (mesial view); F, left 3rd pereopod (lateral view); G, dactyl of left 3rd pereopod (mesial view); H, anterior lobe of sternite of 3rd pereopods; I, telson. Scales = 5 mm (A–G) and 3 mm (H, I).

Antennular peduncles overreach ocular peduncles by ½–¾ length of ultimate segment. Ultimate segment with tuft of setae at dorsodistal margin laterally.

Antennal peduncles overreach ocular peduncles by ⅓–½ length of ultimate segment. Fifth and fourth segments with scattered setae. Third segment with acute spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in strong spine, 1–5 accessory spines and/or spinules on mesial and lateral margins; dorsomesial distal angle with

acute spine, mesial margin with few setae. Basal segment with small spine on laterodistal angle. Antennal acicle reaching nearly to distal margin of cornea and terminating in strong spine, mesial margin with row of tufts of setae. Antennal flagellum long, but rarely overreaching tip of right cheliped; usually every 2nd or 3rd article with 1 or 2 very short setae and occasionally 1 or 2 slightly longer setae every several articles.

Right cheliped with dactyl somewhat triangular in cross-section; as long or slightly longer than palm and overlapped by fixed finger; cutting edge with row of calcareous teeth of varying size, terminating in corneous claw; dorsal surface with irregular rows of low tubercles, dorsomesial margin depressed ventrally and armed with row of tubercles, sometimes rather indistinct; ventral surface with 1 or 2 rows of tufts of moderately long setae. Palm ½–⅔ length of carpus; dorsomesial margin depressed, dorsomesial component almost perpendicular, delineated above by tubercular or spinose ridge indistinctly continuous with broad ridge of tubercles adjacent to cutting edge of fixed finger; dorsal surface with scattered tubercles (sometimes only obscurely apparent) or small spines and with row of stronger spines or tubercles in midline, dorsolateral margin with row of acute or blunt spines on palm, often appearing as very closely-spaced tubercles on fixed finger; lateral face convex and spinulose or tuberculate on palm, ventral surface weakly tuberculate. Carpus as long or slightly longer than merus; dorsomesial margin with double row of acute spines proximally, becoming single marginal and medially oblique rows distally, dorsal surface with numerous small spines or tubercles, distal margin with several spines, dorsolateral margin not distinctly delimited; mesial face concave and with few low tubercles near distal margin, frequently also with low transverse ridges and tufts of setae; lateral face weakly tuberculate, ventrolateral margin with row of low tubercles, ventral surface with few low tubercles. Merus with acute spine at dorsodistal margin and frequently 2 or 3 additional spines in distal third, often accompanied by transverse rows of tufts of setae; mesial and lateral faces with transverse rows of long setae, occasionally with few tubercules or spinules ventrally, ventrolateral margin with row of spines, more acute in distal half; ventral surface with few low tubercles and tufts of setae, ventromesial margin with row of small spines, occasionally practically obscured by tufts of long setae. Ischium with few small spines or spinules on ventromesial margin and tufts of long setae.

Left cheliped triangular in cross-section; propodal-carpal articulation usually in horizontal plane. Dactyl 2¼–3 times length of palm; cutting edge with row of corneous teeth, terminating in small corneous claw and slightly overlapped by fixed finger; dorsomesial margin with row of small spines or tubercles in proximal half, dorsal surface with 1 or 2 rows of tufts of setae and occasionally few small tubercules or spinules in midline. Palm ⅓–½ length of carpus; markedly elevated in midline to prominent median crest armed with single row of very closely-spaced tubercles or with row of small spines, dorsolateral margin crenulate or tuberculate, sloping to ventral position on fixed finger, dorsolateral surface usually unarmed on palm but usually with few tubercles on fixed finger, dorsomesial surface of palm with few spines or tubercles, dorsomesial margin with row of tubercles. Carpus slightly shorter than merus and broadened distally; dorsolateral margin with row of moderately strong spines and tufts of long setae, row of somewhat smaller spines and tufts of setae on dorsomesial margin; lateral face with scattered, low, sometimes spinulose protuberances and numerous tufts of long setae, 1 or 2 prominent spines at or near distal margin; mesial face with scattered tufts of setae and few tubercles on distal margin; ventral surface with low protuberances, tubercles or small spines and tufts of setae. Merus with transverse, sometimes spinulose ridges and long setae on dorsal surface primarily in distal half; ventromesial and ventrolateral margins each with row of spines, sometimes becoming exceptionally strong proximally, and tufts of dense setae. Ischium with row of small spines or spinules on ventromesial margin partially obscured by tufts of short setae.

Right and left 2nd and right 3rd pereopods similar. Dactyls slightly longer than propodi; in dorsal view, slightly twisted; in lateral view, slightly curved; terminating in small corneous claw; dorsal surfaces with low protuberances and tufts of setae, mesial faces each with dorsal and ventral row of corneous spinules, ventral margins each with 13–21 corneous spinules, lateral faces slightly convex and often with a row of short setae near ventral margin. Propodi ¼–⅓ longer than carpi; dorsal surfaces with low protuberances and tufts of setae, ventral surfaces each with row of small corneous spinules partially obscured by tufts of setae, mesial and lateral faces each with row of short, widely-spaced

setae dorsally and ventrally. Carpi slightly shorter than meri, 2nd and frequently also 3rd each with row of spines on dorsal margin, strongest on 2nd right. Meri with low protuberances and tufts of setae on dorsal surfaces, ventrolateral margins each with row of spines (2nd) or weak to moderately well developed protuberances (3rd), all surfaces also with tufts of short to long setae. Ischia with tufts of setae on ventral margins. Left 3rd pereopod with dactyl, in dorsal view, more strongly twisted, lateral face markedly concave, unarmed, dorsal surface broad and flattened, dorsomesial and dorsolateral margins each with row of stiff bristles or thin corneous spinules, ventral margin with 17–23 short corneous spinules, mesial face convex and with single or double dorsal and ventral rows of corneous spinules. Propodus broad, lateral face flattened or slightly concave; dorsal surface with transverse rows of short setae, mesial face with dorsal and ventral rows of widely-spaced setae, ventral surface with row of small corneous spinules and transverse row of similar spinules at distal margin. Carpus, merus and ischium similar to 3rd right.

Anterior lobe of sternite of 3rd pereopods subrectangular to subsemicircular, anterior margin with long, thick setae. Fourth pereopod with small preungual process at base of claw. Telson with posterior lobes slightly asymmetrical, terminal margins oblique, each with few strong spines and numerous smaller spines extending onto lateral margins.

Colour. "Eyestalks orange-red proximally tending to pale blue distally, antennules pale blue or mauve; antennae strongly barred dark red-brown and white; chelipeds orange-red with longitudinal reddish stripes and white areas around the joint region, especially that between carpopodite and meropodite; walking legs orange-red with longitudinal reddish stripes and white areas around the joint regions." (Schembri and McLay, 1983)

Distribution. Southern New Zealand; subtidal to 293 meters.

Affinities. Lophopagurus thompsoni is most closely related to, and has often been confounded with, *L. foresti* sp. nov. There are only subtle differences in the armature of the right cheliped in the two species, and intraspecific variations make these differences unreliable as diagnostic characters. Both species also are similarly coloured, particularly the longitudinally-striped ambulatory legs. The armature of the pereopods, particularly the carpi of the 2nd and frequently also the 3rd, and the dactyl of the left 3rd afford immediate separation of the two species. The carpi of the 2nd pereopods, at least the right, of *L. thompsoni* have a full row of spines on the dorsal surface. The 3rd pereopods often are similarly armed, although the spines are smaller and may be fewer in number; however, these spines occasionally are represented only by spinulose protuberances or may be entirely absent. The ventral margin of the dactyl of the 3rd left pereopod is armed with 21–23 small corneous spinules. The dorsolateral surface of the palm of the left chela is usually smooth. In contrast, the carpi of the 2nd pereopods in *L. foresti* are provided with a single dorsodistal spine; occasionally 1, or very rarely 2, additional spine(s) may develop in the proximal half of the dorsal surface. Only a single dorsodistal spine is present on the carpi of the 3rd pereopods. The ventral margin of the dactyl of the 3rd left pereopod is armed with 11–16 corneous spinules. The dorsolateral surface of the palm of the left chela most frequently is tuberculate at least proximally. *L. thompsoni* is also generally similar in appearance to *L. lacertosus*. Again the pereopods, particularly the 3rd left, provide distinguishing characters. In *L. thompsoni* there is a marked difference between the 2nd and 3rd left pereopods. The dactyl of the 3rd is appreciably shorter, broader, and has a conspicuously concave lateral face. Additionally, the ventral margins of the dactyls of both 2nd and 3rd pereopods are armed with short corneous spinules. In *L. lacertosus*, the 2nd and 3rd pereopods are generally similar in size and conformation, although there is a tendency in females for the lateral face of the dactyl of the 3rd left to become slightly concave; the ventral margins of the dactyls are armed with considerably longer spinules, particularly in the distal fourth.

Remarks. Filhol (1885a) published his first description of *Eupagurus thompsoni* in a relatively unknown account of the crustacean fauna of New Zealand. This initial description was brief and lacked illustrations. In a subsequent report published later that same year, Filhol (1885b) repeated the cryptic description, but provided an illustration of the whole animal (pl. 51 fig. 6). It is his description in the "Mission de l'Île Campbell" that is most frequently cited as the original. In this report, the figure legends for plate 51 state that figure 7 is also an illustration of the left chela of *E. thompsoni* but this clearly is incorrect. The illustrated appendage bears no

resemblance to that depicted for the whole animal. Filhol's whole animal illustration is also inaccurate in showing no abdominal pleopods.

Filhol (1885a) confounded two species under the name *thompsoni*; his figure (1885b, pl. 51 fig. 6) seems to be a composite of both. At least three syntypes of Filhol's taxon exist. The first, representing one of the species, is represented in the collections of the Muséum National d'Histoire Naturelle, Paris (Forest, 1961; pers. comm.). A second syntype, representing the second species, (USNM 22927) part of a gift from E.-L. Bouvier in 1899 (cf. Manning and Holthuis, 1981), is in the collections of the National Museum of Natural History, Smithsonian Institution. A third syntype (RMNH 1661), also representing the second species, is in the collections of the Nationaal Natuurhistorisch Museum, Leiden. During their work with New Zealand pagurids, Forest and de Saint Laurent (unpublished) provided illustrations, descriptions and working keys to New Zealand carcinologists, and it is upon these data that subsequent local faunal and systematic studies have been based (e.g., Schembri and McLay, 1983; Probert and Wilson, 1984; Schembri, 1988). Consequently, it is deemed most appropriate, and in the interest of stability in nomenclature, that the specimen from the Muséum National d'Histoire Naturelle, Paris, be selected as the lectotype of *Eupagurus thompsoni* Filhol. The remaining two syntypes represent an undescribed species. The specimen from the U.S. National Museum of Natural History (USNM 22927) is designated the holotype of this second species, *Lophopagurus foresti* sp. nov.

We have not had the opportunity to examine the lectotype of *E. thompsoni* directly because of its present poor condition; however, J. Forest has meticulously compared it with specimens from the New Zealand Oceanographic Institute, currently in Paris, and two of these latter specimens (1 male, 8.4 mm and 1 ovigerous female, 7.4 mm) from NZOI stn B 556 have been provided for our examination.

Thomson (1898) repeated Filhol's (1885b) description of "*Eupagurus thomsoni*" (sic), but indicated that he had no personal knowledge of this species. His report, therefore, referred to both of the taxa confounded by Filhol (1885a, b). It would appear that Thomson's (1898) report was the first introduction of the second spelling attributed to Filhol's species.

Alcock (1905) merely presented a list of species; however, in citing both Filhol (1885b) and Thomson (1898) as references to the species, he also was referring to both taxa.

Chilton (1911) noted that while the specimens he identified as *Eupagurus thomsoni* agreed with Filhol's (1885b) short description, the carpus of the right cheliped was not nearly as spiny as Filhol's figure would suggest. We have reexamined Chilton's (1911) four specimens from "Nora Niven" stns 5 and 17 (CMC) and found that while they do agree with one of the two taxa confounded by Filhol under the name *thompsoni*, they are referable to *L. foresti* sp. nov.

Thompson (1930) provisionally referred a series of specimens to *Eupagurus thompsoni*, including those identified by Chilton. Thompson remarked on the variability of his specimens and noted that in many particular points his specimens seemed closer to *L. crenatus* (Borradaile). Since Thompson did not describe the configuration and armature of the pereopods, it is impossible, without first hand examination, to know what taxa were actually represented. Thompson's specimens have yet to be examined.

Gordan's (1956) bibliography of pagurids listed both *Pagurus thomsoni* and *P. thompsoni*. The former name she attributed to no author, but implied its synonymy with *Pagurus pubescens* Krøyer. Her citations for *P. thompsoni* (Filhol, 1885) include authors who were referring to both *P. thompsoni* Bell and *P. thompsoni* (Filhol).

Eupagurus thompsoni Filhol became a secondary junior homonym when the International Commission for Zoological Nomenclature placed *Eupagurus* on the Official Index of Rejected and Invalid Generic Names in Zoology (ICZN, 1957; Hemming, 1958). Forest, in Pike (1961), pointed out that Filhol's (1885a) specific name *thompsoni*, also spelled *thomsoni* by Forest was preoccupied by *Pagurus thompsoni* Bell (1853). In his discussion, Forest stated that he had compared Pike's (1961) parasitized specimen with Filhol's type in the Paris museum and had found them identical. However, he also thought that both agreed with Henderson's (1888) description of *Eupagurus lacertosus* and because Filhol's name was preoccupied, *Pagurus lacertosus* was the correct name. As previously noted, *L. thompsoni* and *L. lacertosus* bear a superficial resemblance to one another; however, the two are distinct taxa, a conclusion also subsequently reached by Forest (pers. comm.). Although *lacertosus* is not available as a replacement name for *thompsoni*, the need for

such a name no longer exists. Forest and de Saint Laurent (1967) transferred both *P. thompsoni* and *P. lacertosus* to *Pylopagurus*; McLaughlin (1981a) placed them in *Lophopagurus*. According to ICZN Art. 59(c) "If, in the case of secondary homonymy, the junior species-group name has not been replaced [Art. 60], and the taxa in question are no longer considered congeneric, the junior name is not to be rejected ...". Clearly Bell's and Filhol's species cannot be considered congeneric, therefore Filhol's specific name, *thompsoni* is retained.

McLaughlin (1981a) was unaware that Filhol had confounded two species under the name *thompsoni* when she designated *Eupagurus thompsoni* as the type species of *Lophopagurus*. At the time, her interpretation of Filhol's species was based, in part, on the photographs provided by J. Forest and M. de Saint Laurent, and in part on the syntype from the National Museum of Natural History (USNM 22927). The generic diagnosis of *Lophopagurus* was made from a review of the four species assigned at the time, i.e., *Pylopagurus thompsoni* sensu lato, *P. lacertosus*, *P. nanus*, and *P. crenatus*. Designation of *P. thompsoni* as the type species was an arbitrary decision, thus misinterpretation of the type species, in the meaning of ICZN Art. 70, presents no problem.

Lophopagurus foresti sp. nov.

Figures 1A,C, E, 3

Eupagurus thompsoni Filhol, 1885a: 33 (in part); 1885b: 423 (in part), pl. 51 fig. 6 (? in part), not fig. 7. — Alcock, 1905: 176 (in part). — McLaughlin, 1981a: 3 (in part), see remarks under *L. thompsoni*.

Eupagurus thomsoni. — Thomson, 1898: 183 (in part). — Chilton, 1911: 298; see remarks under *L. thompsoni*.

Pagurus thompsoni. — Gordan, 1956: 336 (in part), see remarks under *L. thompsoni*.

Pylopagurus thompsoni. — McLaughlin, 1981a: 3 (in part), see remarks under *L. thompsoni*.

Lophopagurus thompsoni. — McLaughlin, 1981a: 3 (by implication) (in part), see remarks under *L. thompsoni*.

Type material. Holotype: Cook Strait, New Zealand, USNM 22927 (male, 5.3 mm).

Paratypes: RV *Acheron* stn BS 389, between Three Kings Islands and North Cape (34°21'S 172°37'E), 58 m, 19 Feb 1974, NMNZ Cr8181 (1 male, 2.0 mm). West end Great Island, Three Kings Islands, G. Hardy and A. Stewart, 3–7 m, 28 Nov 1983, NMNZ Cr8036 (1 male, 2.5 mm). RV *Tangaroa* NZOI stn R 90 (37°46.5'S, 176°38.5'E), 39 m, 21 Jan 1979, NMNZ Cr8330 (1 male, 5.0 mm). RV *Acheron* stn BS 490 (39°57'S, 174°34'E), 33–35 m, 2 Mar 1976, NMNZ Cr8331 (6 males, 2.9–5.2 mm). Cook Strait, New Zealand, RMNH 1661 (1 male, 4.4 mm). RV *Acheron* stn BS 488 (40°09.5'S, 174°36'E), 82 m, 2 Mar 1976, NMNZ Cr4911 (4 males, 2 females, 2.4–4.1 mm). Wellington Harbour, M. Davidson, 19 m, 17 Apr 1980, NMNZ Cr4109, 4113 (3 male, 6 females, 5.0–7.9 mm); M. Davidson, 17 m, 7 May 1980, NMNZ Cr4110 (1 male, 7.2 mm). RV *Acheron* stn BS 511 (40°46'S, 173°52.5'E), 18 m, 5 Mar 1976 NMNZ Cr8332 (1 male, 5.2 mm). RV *Acheron* stn BS 541 (40°46.5'S, 173°57'E), 59–64 m, 11 Mar 1976, NMNZ Cr8333 (1 male, 7.6 mm). RV *Acheron* stn BS 531 (40°52'S, 172°04'E), 64 m, 10 Mar 1976, NMNZ Cr8334 (1 male, 6.7 mm). RV *Acheron* stn BS 500 (40°57'S, 174°18'E), 139–144 m, 3 Mar 1976, NMNZ 7396 (1 male, 1 female, 4.8, 5.8 mm, female with rhizocephalan). RV *Acheron* stn BS 514 (40°57.5'S, 174°01.5'E), 29 m, 5 Mar 1976, NMNZ Cr8335 (3 males, 1 female, 3.9–7.7 mm). RV *Acheron* stn BS 504 (40°59.5'S, 174°08'E), 18–22 m, 4 Mar 1976, NMNZ Cr8336 (1 male, 1 female, 5.2, 7.2 mm). Bushette Shoal, Kaikoura, 56 m, R. Pilgrim, 14 Nov 1964, NMNZ Cr4111 (1 intersex, 6.6 mm). USNS *Eltanin* stn 16/1431 (45°37'S, 170°58'E), 51 m, 23 Feb 1965, USNM 244457, 244460, NHRM type colln 4371 (12 males, 8 females, 2.9–6.6 mm). *Nora Niven* stns 5 (50 mi. E of Wreck Reef) and 17 (8 mi. NE of Cape Saunders), 117 m, 102–192 m, 13, 25 Jun 1907, CM (3 males, 1 female, 4.8–6.5 mm).

Description. Shield longer than broad; anterior margin between rostrum and lateral projections concave; posterior margin truncate. Rostrum triangular, acute, often terminating in small spinule. Lateral projections broadly rounded, usually with strong marginal or submarginal spine.

Ocular peduncles ⅔–¾ length of shield; dorsomesial face with row of tufts of setae. Ocular acicles slender, terminating acutely and with strong submarginal spine; separated basally by width of rostrum, or slightly less than basal width of 1 acicle.

Antennular peduncles when extended usually exceeding ocular peduncles by ⅓–½ length of ultimate segment, occasionally not overreaching corneae. Ultimate segment with tuft of long setae near distal margin and often row of widely-spaced, short setae on ventral surface. Penultimate segment usually glabrous. Basal segment with very strong, acute spine on lateral face dorsally, tuft of setae on mesial face.

Antennal peduncle usually reaching to extremity of cornea. Fifth and fourth segments with scattered setae. Third segment with acute spine at ventrodistal angle usually obscured by tuft of long setae. Second segment with dorsolateral distal angle produced, terminating in acute

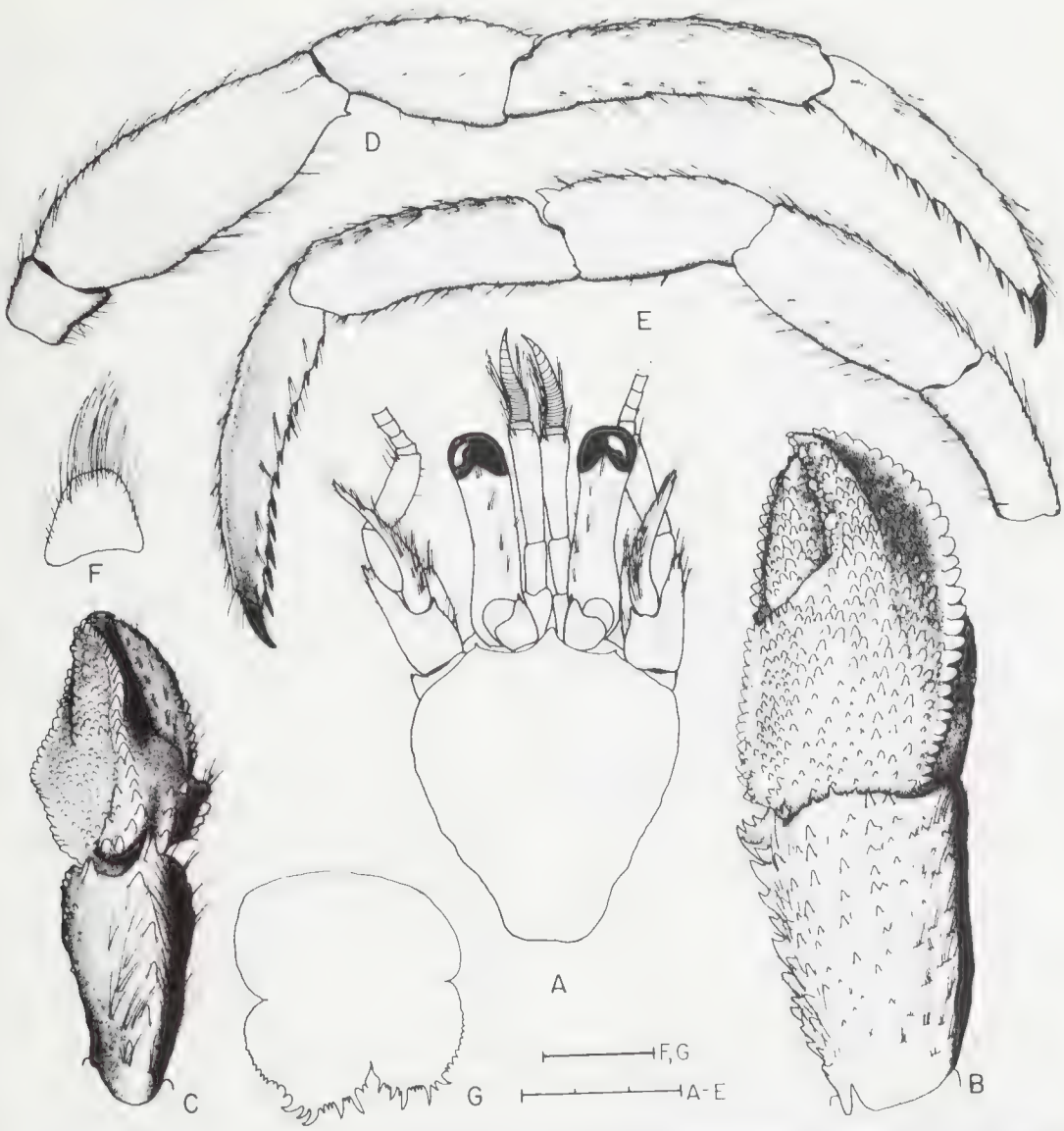


Figure 3. *Lophopagurus foresti* sp. nov. holotype, from Cook Strait, New Zealand, USNM 22927. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scales = 3 mm (A–E) and 1 mm (F, G).

spine, mesial and lateral margins with 1–3 accessory spinules and few setae; dorsomesial distal angle with acute spine, mesial face weakly setose. First segment with small spine on lateral face distally, ventral margin produced, with 1 spine distolaterally. Antennal acicle terminating in strong spine, mesial face with row of tufts of moderately long setae. Antennal flagellum sometimes overreaching right cheliped, with 1 very short seta each article and 2 slightly longer (»1 article length) setae every 2–4 articles in proximal half.

Right cheliped with dactyl slightly longer than palm; cutting edge with row of strong calcareous teeth in proximal ¾–⅘, corneous teeth distally; terminating in corneous claw. Dorsal surface of dactyl elevated in midline and armed with irregular row of small to very strong spines or tubercles, dorsomesial and dorsolateral surfaces spinulose or tuberculate, dorsomesial margin

with row of small to large spines or tubercles. Palm slightly more than half length of carpus; dorsomesial margin with single or double row of small to large tubercles, dorsomesial component flat to strongly concave, weakly to strongly tuberculate, delineated dorsally by curved, tuberculate ridge extending to tip of fixed finger, dorsal surface covered with blunt spines or tubercles and with elevated ridge laterad of midline extending onto fixed finger, dorsolateral margin with large, compressed tubercles, sometimes becoming more spine-like on fixed finger; lateral face convex proximally and with scattered tubercles; ventral surface with scattered tufts of setae, longest and thickest on fixed finger and dactyl. Carpus approximately as long as merus; dorsomesial margin with irregular row of moderately strong spines, dorsal surface with single or double row of tubercles mesiad of midline, sometimes only weakly tuberculate and with low, transverse, sometimes spinulose ridges and tufts of setae laterally, distal margin with 3–5 small spines, dorsolateral margin not delimited; ventrolateral margin with row of small blunt spines distally, sometimes only crenulate; mesial face often with 1–3 spines or tubercles on distal margin; ventral surface with few low tubercles and scattered tufts of setae. Merus with strong, acute spine on dorsodistal margin; ventromesial margin with row of blunt spines in proximal half and 1 or 2 spinules distally; ventral surface with few blunt spines or tubercles, ventrolateral margin with row of spines, strongest and most acute distally. Ischium with row of spines or spinules on ventromesial margin and occasionally 1 acute spine on lateral face ventrally.

Left cheliped usually not reaching beyond base of dactyl of right; propodal-carpal articulation in horizontal plane. Dactyl 2–4 times longer than palm; overlapped by fixed finger and sometimes with small hiatus proximally; cutting edge with row of corneous teeth; terminating in strong corneous claw. Dorsal surface of dactyl unarmed but often with row of tufts of setae near dorsomesial margin and second near cutting edge, dorsomesial margin with few blunt spines or tubercles proximally. Palm ¼–⅓ length of carpus, midline with prominent elevated crest armed with single row of simple or corneous-tipped spines or tubercles extending almost to tip of fixed finger, dorsolateral face spinulose or tuberculate, dorsolateral margin with blunt tubercles proximally often becoming corneous-tipped spines distally, margin markedly depressed ventrally on fixed finger, dorsomesial face with few spinules, dorsomesial margin with row of 2–4 small spines. Carpus with single row of spines on dorsolateral margin and 2 or 3 spines on distal margin; lateral face with transverse ridges and tufts of setae, occasionally few spinules and 1 or 2 spines dorsally, distal margin with 1–3 prominent spines dorsally and sometimes also few smaller spines; mesial face with short, transverse rows of tufts of setae, occasionally also with 1 small spine on distal margin dorsally and few low protuberances ventrally; ventral surface with tufts of setae and frequently several small spines or tubercles. Merus with row of tufts of setae on dorsal margin; ventromesial margin with row of spines, strongest in proximal third, ventrolateral margin with row of spines, strongest in distal half. Ischium with row of blunt spines on ventromesial margin and frequently small spine on laterodistal margin ventrally.

Ambulatory legs often overreaching right cheliped; left 3rd pereopod dissimilar; all terminating in strong corneous claws. Dactyls of 2nd pereopods and 3rd right ¼–⅕ longer than propodi; dorsal surfaces each with row of stiff setae, ventral margins each with 9–13 corneous spines, mesial faces each with row of corneous spinules near dorsal margin and row of stiff bristles or bristle-like corneous spinules near ventral margin. Propodi each with 2 corneous spinules at ventrodistal angle and row of spinules on ventral surface, dorsal and ventral surfaces also with rows of stiff setae. Carpi each with strong dorsodistal spine and sometimes 1 additional spine in proximal half (2nd right, occasionally also 2nd left) and tufts of long setae. Meri each with row of tufts of setae on dorsal margin, 2nd with row of spines on ventrolateral margin (at least left) and 1 acute spine at ventrolateral distal angle, 3rd unarmed, but with tufts of setae. Ischia unarmed. Third left pereopod with lateral surface of dactyl conspicuously concave, ventral surface broad, with outer margin frequently thickened and occasionally with small calcareous nodules developed, row of 11–16 strong, corneous spines on inner margin, mesial face with double row of corneous spines dorsally and additional single or double row ventrally. Propodus with lateral surface somewhat flattened, ventral surface with row of corneous spinules and 1 corneous spine at ventrodistal angle. Carpus with single dorsodistal spine and tufts of setae on dorsal surface. Merus with tufts of setae on dorsal and ventral margins.

Anterior lobe of sternite of 3rd pereopods subsemiovate to subsemicircular, anterior margin

with long setae. Fourth pereopod with small preungual process at base of claw. Telson with numerous small spines and few stronger spines on terminal margins extending on to lateral margins.

Colour. (In preservative 4 years): Antennal flagella alternately banded reddish brown (4–7 articles) and translucent or white (2 or 3 articles). Right cheliped with 2 longitudinal orange stripes on the dorsal surface of the palm, 1 extending onto fixed finger and second at the cutting edge, 1 additional at the dorsodistal margin of the dactyl. Left cheliped with longitudinal orange stripe on the dorsolateral face of the left chela. Ambulatory legs with 4 longitudinal orange stripes visible in lateral view on the propodi, carpi and meri and 1–3 on dactyls.

Etymology. This species is dedicated to Professor Jacques Forest in recognition of his contributions, not only to our knowledge of the New Zealand hermit crab fauna, but to the hermit crab fauna of the world.

Distribution. Northern, central and south-eastern New Zealand; 18–192 m.

Affinities. L. foresti is very similar to *L. thompsoni.* However, it may be distinguished from the latter species by the carpi of the ambulatory legs, which carry only single spines at the dorsodistal margins of the carpi, or occasionally an additional (or very rarely 2) spine(s) posteriorly on the 2nd. The small number of corneous spinules (11–16) on the ventral margin of the dactyl of the 3rd left pereopod in *L. foresti* will also usually separate it from *L. thompsoni. Lophopagurus foresti* also bears considerable similarity to *L. nanus*; however, the distinct difference between the dactyls of the left 2nd and 3rd pereopods, (3rd with markedly concave lateral face) will immediately distinguish *L. foresti* from *L. nanus*, a species in which the configurations of the dactyls are all similar.

Remarks. A single, apparently "intersex", specimen from Bushette Shoal, Kaikoura, NZ (NMNZ Cr4111) was observed with male pleopods, a single female gonopore and no gonopods. There was no external indication of parasitism.

Lophopagurus nodulosus sp. nov.

Figure 4A–H

Pylopagurus crenatus. — Probert et al., 1979: 381. Not *Pylopagurus crenatus* (Borradaile) (see remarks).

Lophopagurus sp. nov. — Schembri, 1982: 870.

Lophopagurus n. sp. — Schembri and McLay, 1983: 30, figs 9a, b. — Schembri, 1988: 93.

Type material. Holotype: North side Punui Bay, Snares Island, New Zealand, 50 m, 24 Feb 1976, NMNZ Cr8347 (male, 6.4 mm).

Paratypes: North side Punui Bay, Snares Island, New Zealand 50 m, 24 Feb 1976, NMNZ Cr4912 (1 male, 5.9 mm); 50 m, 24 Feb 1979, Cr7397 (4 males; 1 female, 3.3–7.4 mm). USNS *Eltanin* stn 25/370 (43°22′S, 175°20′E), 95 m, 19 Nov 1966, USNM 244458 (1 male, 6.9 mm). USNS *Eltanin* stn 51/590 (52°08.5′S, 169°43.7′E), 90–91 m, 20 Jan 1972. USNM 244454 (1 male, 2.5 mm). USNS *Eltanin* stn 25/368 (43°16′S, 175°23′E), 84 m, 19 Nov 1966, USNM 244443, NHRM type colln 4372, RMNH D 40429 (2 males, 1 female, 1 ovigerous female, 5.0–7.4 mm). Perseverance Harbour, Campbell Island, 11 m, K. Westerskov, 12 Feb 1985, NMNZ Cr4867 (1 male, 6.7 mm). Proclamation Island, Bounty Islands, D.S. Horning, 38 m, 8 Nov 1978, NMNZ Cr8197 (9 males, 10 females, 2 ovigerous females, 3.4–6.7 mm).

Description. Shield longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins terraced or sloping; posterior margin truncate; dorsal surface with few scattered tufts of setae. Rostrum bluntly triangular, with very minute terminal spinule. Lateral projections broadly rounded, with moderately well developed submarginal spine.

Ocular peduncles ¾–⅘ shield length; corneae slightly dilated; dorsomesial surface with row of tufts of setae. Ocular acicles narrowly triangular, with strong, but not elongate, submarginal spine; separated basally by slightly less than basal width of 1 acicle.

Antennular peduncles when extended overreach ocular peduncles by ¼–⅓ length of ultimate segment. Ultimate segment with few scattered setae and tuft of setae at dorsolateral distal angle. Penultimate segment with few scattered setae. Basal segment with acute spine laterally.

Antennal peduncles only slightly overreaching ocular peduncles. Fifth and fourth segments with scattered setae. Third segment with small spine at ventral margin obscured by tuft of setae. Second segment with dorsolateral distal angle produced, terminating in strong spine, mesial margin with 2–5 accessory spines, lateral margin with 1 or 2 accessory spines; dorsomesial distal angle with acute spine, mesial face with tufts of setae. First segment with small spine at dorsolateral distal angle, ventral margin produced and with 1 spine laterally. Antennal acicle reaching beyond base of cornea and sometimes overreaching cornea; slightly arcuate and terminat-


G,H
A-F
D
E
F
G
C
B
A
H

ing in strong spine, mesial margin with tufts of stiff setae. Antennal flagellum not overreaching right cheliped; articles each with 1–3 minute setae and 1 or 2 slightly longer (≈1 article length) every 2nd to 5th article, at least in proximal half.

Right cheliped with dactyl only slightly longer than palm; cutting edge with 3 or 4 calcareous teeth and short distal row of corneous teeth; terminating in small corneous claw and slightly overlapped by fixed finger. Dorsomesial margin of dactyl with closely-set, blunt spines proximally becoming more spine-like distally, dorsal surface with raised row of prominent tubercular nodules and few scattered low tubercles; mesial and ventral surfaces with scattered tufts of stiff setae. Palm half length of carpus; dorsomesial margin with ridge of blunt or spinulose tubercles, dorsomesial component concave, surface with numerous tubercles, delimited above by elevated tuberculate ridge; dorsal surface of palm with very prominent ridge of tubercles or nodules in midline and similar row of tubercles extending length of fixed finger, remaining surface of palm with numerous large tubercles, remaining surface of fixed finger concave and armed only with few very small tubercles, dorsolateral margin with row of spines, becoming more tuberculate on fixed finger; lateral face convex, with 1 or 2 irregular rows of tubercles dorsally and low protuberances ventrally. Carpus slightly longer than merus; dorsomesial margin with double row of spines marginally and adjacent oblique row, dorsal surface with numerous tufts of setae, 1 or 2 rows of spines in midline and scattered spines or spinules particularly laterad of midline, dorsolateral margin delimited only by irregular row of transverse, spinulose ridges and tufts of setae; lateral face with scattered tufts of setae and few blunt spines on distal margin dorsally, ventrolateral margin with row of protuberances, tubercles or spines; mesial face concave, unarmed but with numerous tufts of setae. Merus with acute spine at dorsodistal margin, dorsal surface with transverse ridges and tufts of setae, extending onto lateral and mesial faces in distal half; ventrolateral margin with row of tubercles proximally, becoming acute spines distally, ventral surface with few scattered tubercles, ventromesial margin with row of spines or spinulose tubercles. Ischium with tufts of setae on ventromesial margin.

Left cheliped reaching to base of dactyl of right or slightly beyond; propodal-carpal articulation approximately in horizontal plane. Dactyl 2–3 times length of palm; terminating in corneous claw and slightly overlapped by fixed finger; cutting edge with row of corneous teeth; dorsomesial margin with few low spinules or tubercles in proximal third, dorsal, mesial and ventral surfaces with rows of tufts of setae. Palm ¼ length of carpus; midline very strongly elevated into crest composed of fused tubercles presenting scalloped appearance, usually continuing to tip of fixed finger, dorsolateral margin crenulate proximally, becoming row of weak spines on fixed finger, dorsolateral surface smooth or slightly pitted and with low tuberculate ridge in proximal half of fixed finger, dorsomesial face of palm with few tubercles, dorsomesial margin with 3 spinulose lobes. Carpus approximately equaling length of merus; dorsolateral margin with row of strong spines, dorsomesial margin sometimes with 1 or 2 spines proximally and row of tufts of long stiff setae, 1 strong, acute spine on dorsodistal margin; mesial face with low, transverse ridges and tufts of setae; laterodistal margin with 1 strong and 1–3 smaller spines; ventral surface and ventrolateral and ventromesial margins all with tufts of setae. Merus with row of stiff setae on dorsodistal margin and tufts on setae on dorsal surface; ventromesial margin with 2 prominent, blunt spines in proximal half and 1 or 2 smaller spines in distal half, ventrolateral margin with row of acute spines. Ischium with tufts of setae on ventromesial margin.

Second pereopods and 3rd right similar; in dorsal view, slightly twisted; in lateral view, very slightly curved ventrally; terminating in strong, corneous claws. Dactyls slightly longer than propodi; dorsal surfaces slightly flattened, dorsomesial margins each with row of corneous spinules and tufts of long, stiff setae, dorsolateral margins with tufts of stiff setae, mesial faces each with partial or complete row(s) of corneous spinules and tufts of stiff setae dorsally and ventrally

Figure 4. *Lophopagurus nodulosus* sp. nov., male paratype from *Eltanin* stn 25/370, USNM 244455. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, dactyl of right 2nd pereopod (mesial view); F, left 3rd pereopod (lateral view); G, anterior lobe of sternite of 3rd pereopods; H, telson. Scales = 3 mm (A–F) and 1 mm (G, H).

(2nd) or complete row(s) of corneous spinules and tufts of setae (3rd); ventral margins each with 10–12 corneous spinules, lateral faces with scattered tufts of setae. Propodi ⅓–⅔ longer than carpi; with low protuberances and tufts of long stiff setae on dorsal surfaces, ventral surfaces each with row of corneous spinules, mesial faces each with row of tufts of setae dorsally and ventrally. Carpi approximately ⅔ length of meri; each with low protuberances and tufts of setae on dorsal surface and single dorsodistal spine, rarely with second dorsal spine in proximal half (2nd). Meri with dorsal and ventral tufts of long setae, each also with acute spine at ventrolateral distal angle and 1–4 spines on ventral surface (2nd) or unarmed (3rd). Ischia with tufts of long, stiff setae on dorsal and ventral margins. Third left pereopod with dactyl ⅕–¼ longer than propodus; in dorsal view, straight; in lateral view, slightly curved ventrally; dorsal surface flattened, dorsolatertal margin often broadly scalloped and with row of tufts of stiff setae and partial row of corneous spinules distally, lateral face markedly concave, ventral margin often tuberculate, with row of 12–15 corneous spines; mesial face sometimes with slight longitudinal sulcus proximally and dorsal and ventral rows of corneous spinules. Propodus slightly longer than carpus; dorsal surface flattened, lateral face flat or slightly concave, unarmed, dorsal surface with rows of tufts of long stiff setae, ventral surface with row of corneous spinules and tufts of long setae, mesial face with transverse rows of tufts of setae and 1 or 2 corneous spinules on distal margin ventrally. Carpus, merus and ischium similar to right 3rd pereopod.

Sternite of 3rd pereopods with anterior lobe subsemicircular. Fourth pereopod with small preungual process at base of claw. Posterior lobes of telson with terminal margins level to oblique, armed with several strong spines interspersed with smaller spines, lateral margins spinulose.

Colour. "Eyestalks reddish; antennules uniform pale reddish-orange; antennae reddish with narrow white bands; chelipeds and walking legs, reddish-orange ground colour with darker bands." (Schembri and McLay, 1983).

Distribution. South-eastern New Zealand, Campbell and Bounty Islands; 11–400 m.

Etymology. From the Latin *nodus*, meaning knotty or knobby, and referring to the nodular appearance of the armature of the right chela.

Affinities. Lophopagurus nodulosus is closely allied to *L. foresti* sp. nov. but is easily separated from that species by the distinctive nodules, rather than spines and tubercles on the dorsal surface of the right chela.

Remarks. In a benthic community study, Probert et al. (1979) listed *Pylopagurus crenatus* (Borradaile) among the species occurring on the continental shelf and upper continental slope off the Otago Peninsula of south-eastern New Zealand. Schembri and McLay (1983), in their annotated key to the hermit crabs of the Otago region, equated Probert et al.'s (1979) *P. crenatus* to their *Lophopagurus* n. sp. We have not seen Probert et al.'s, material; however, McLay (pers. comm.) has confirmed the conspecificity of the material.

Schembri and McLay (1983) reported both *Lophopagurus thompsoni* and *Lophopagurus* n. sp. The distribution of the former species was given as continental shelf (<200 m) and occasionally intertidal, that of the latter restricted to the upper and deep canyon regions (>200 m). The specimen of *L. nodulosus* from Campbell Island was collected from a much more shallow depth (11 m).

Lophopagurus crenatus (Borradaile, 1916)

Figure 5

Eupagurus crenatus Borradaile, 1916: 95, fig. 8. — Thompson, 1930: 270.

Pagurus crenatus. — Gordan, 1956: 328.

Pylopagurus crenatus. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 3.

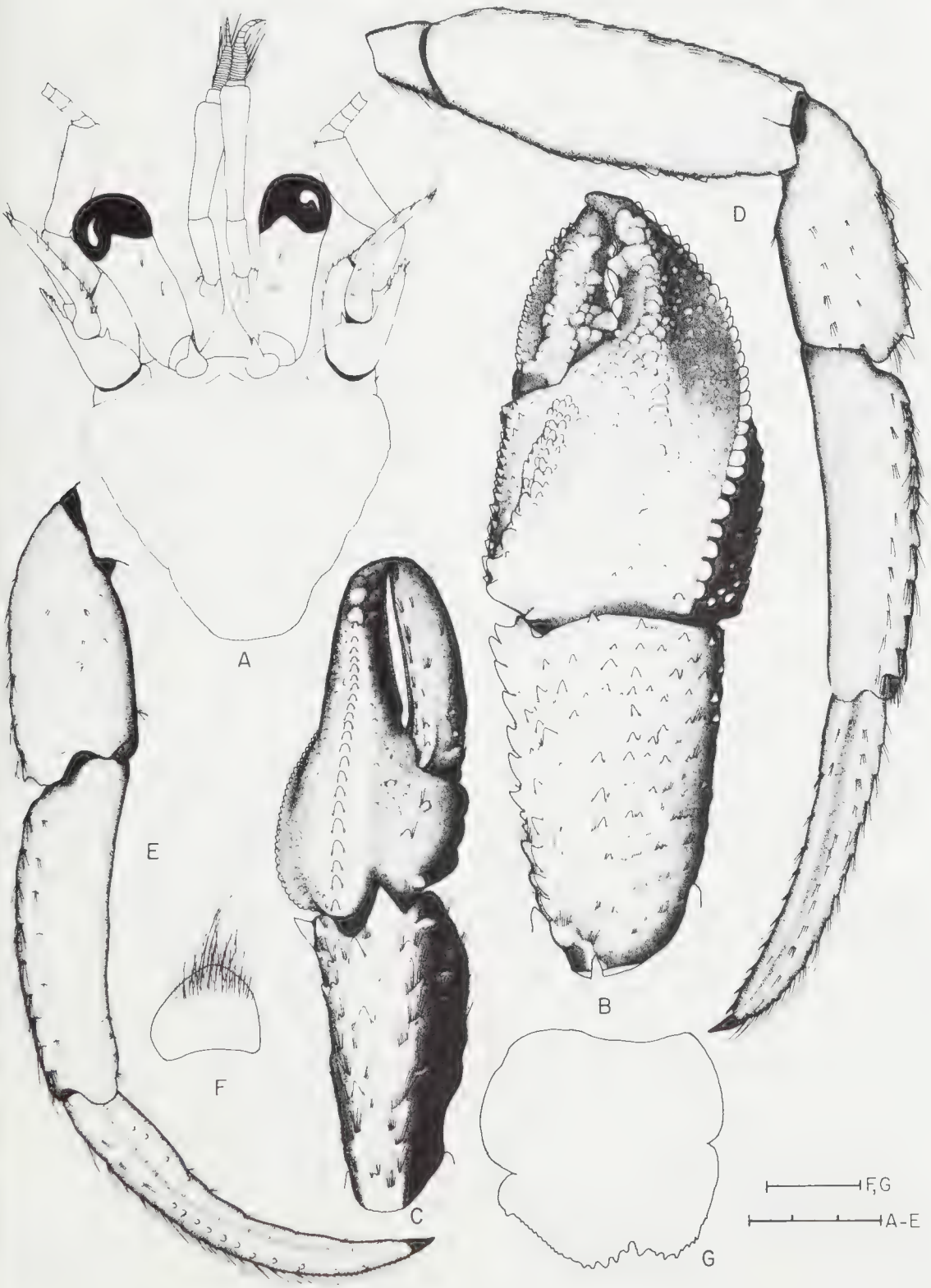
Lophopagurus crenatus. — McLaughlin, 1981a: 3 (by implication).

Not *Pylopagurus crenatus.* — Probert et al., 1979: 381 (= *Lophopagurus nodulosus* sp. nov.).

Type material. Holotype: New Zealand, "*Terra Nova*" stn 90, "From summit, Gt. King, Three Kings Islands, S. 14°W., 8 miles, 183 metres (100 fathoms.), July 25, 1911." BMNH 1917.1.29.134 (male, 5.8 mm).

Other material. None.

Figure 5. *Lophopagurus crenatus* (Borradaile), holotype, from off Three Kings Islands, New Zealand, BMNH 1917.1.29.134. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scales = 3 mm (A–E) and 1 mm (F, G).


A
B
C
D
E
F
G
F,G
A-E

Redescription. Shield slightly broader than long. Rostrum bluntly triangular, without terminal spinule. Lateral projections obtusely triangular, with submarginal terminal spinule.

Ocular peduncles ¾ shield length, moderately stout and with corneae somewhat dilated, few tufts of setae on dorsal surface. Ocular acicles narrowly triangular, terminating acutely and with strong submarginal spine; separated basally by basal width of 1 acicle.

Antennular peduncles when extended overreaching ocular peduncles by ¼ length of ultimate segment.

Antennal peduncles overreaching ocular peduncles by at least ¼ length of ultimate segment. Fifth and fourth segments each with few scattered setae. Third segment with small spine at ventrodistal margin. Second segment with dorsolateral distal angle strongly produced and terminating in strong spine, mesial margin with 5 or 6 small spinules, dorsomesial distal angle with strong spine. First segment with small spine and/or tuft of setae at lateral margin distally, ventral margin produced and with 1 acute spine laterally.

Right cheliped with dactyl slightly less than length of palm, appreciably overlapped by fixed finger, terminating in small corneous claw; dorsomesial margin with row of moderately small tubercles, dorsal surface strongly elevated in midline and with numerous broad, sometimes coalesced tubercles. Palm approximately ⅔ length of carpus; dorsomesial component sloping, delimited dorsally by prominent tuberculate ridge, surface slightly concave and with few small spinules or tubercles, dorsomesial margin with double row of small spines, dorsal surface of palm and fixed finger weakly tuberculate but with prominent tuberculate ridge extending nearly entire length of fixed finger, dorsolateral margin with row of strong, denticulate tubercles; lateral face with scattered tubercles and setae. Carpus with almost double row of strong spines on dorsomesial margin, dorsal surface with scattered small spines and tubercles, dorsolateral margin not delimited; lateral surface weakly tuberculate, ventrolateral margin with row of small spines increasing in size distally, ventromesial surface with low ridges and tufts of long setae. Merus with transverse rows of stiff setae on dorsal margin, dorsodistal margin with 1 strong spine; lateral face minutely tuberculate, ventrolateral margin with row of acute spines and tufts of setae, ventromesial margin with few moderately strong spines. Ischium with row of small tubercles on ventromesial margin.

Left cheliped reaching beyond base of dactyl of right. Dactyl 2½ times length of palm, dorsal surface with 2 or 3 tubercles on slightly elevated proximal midline, dorsomesial surface with few small tubercles dorsally and scattered setae. Palm strongly elevated in midline and armed with row of strong spines, decreasing in size on fixed finger and becoming low broad tubercles distally, dorsolateral face with low granules or minute tubercles, dorsolateral margin with small denticulate tubercles, dorsomesial surface with few granules or minute tubercles and few scattered stronger tubercles or blunt spines. Carpus subtriangular; dorsodistal margin produced into very strong spine in midline, dorsolateral margin with row of widely-spaced strong spines, dorsomesial margin and mesial face with transverse protuberances or low tubercles and tufts of setae; lateral face also with transverse ridges, more spinose in distal half and with strong spine on distal margin both dorsally and ventrally. Merus with tufts of stiff setae on dorsal surface; ventrolateral margin with row of strong, acute spines, lateral face with transverse ridges and tufts of setae, ventromesial margin with 3 subacute spines proximally, ventral surface with few spinules and tufts of setae. Ischium with row of blunt or spinulose tubercles and tufts of thick setae on ventral margin. Coxa with acute spine at ventromesial distal angle and smaller spine on ventrolateral margin distally.

Pereopods overreaching right cheliped by approximately ⅔ length of dactyl, right slightly longer than left. Dactyls slightly longer than propodi; in lateral view, slightly curved ventrally; in dorsal view, twisted; left 3rd somewhat spatulate; dorsal surfaces each with single or double row of stiff setae, lateral faces each with longitudinal sulcus flanked by row of tufts of setae (2nd) or row of low tubercles at least dorsally (3rd), ventral margins each with row of strong, corneous spines, mesial faces each with longitudinal sulcus flanked dorsally by row of corneous spines and ventrally by row of setae (2nd, 3rd right) or row of corneous spinules (3rd left). Propodi with transverse rows of low protuberances and tufts of setae dorsally, 2 corneous spines at ventrodistal margin and row of tufts of setae on ventral margin, mesial and lateral faces each with 1 or 2 rows of tufts of setae. Carpi with irregular row of small spines on dorsal surface (right 2nd) or single spine at dorsodistal margin (3rd) and tufts of stiff setae. Meri with row of

tufts of stiff setae on dorsal margin, lateral face with acute spine near ventrodistal margin and row of small spines on ventral margin (2nd) or unarmed (3rd). Ischia unarmed.

Sternite of 3rd pereopods with anterior lobe semisubcircular. Telson with terminal margins of posterior lobes rounded to slightly oblique, armed with blunt spines; lateral margins as spinulose or spinose plate.

Colour. Unknown.

Distribution. At present known only from Three Kings Islands, New Zealand; 183 m.

Affinities. Lophopagurus crenatus is morphologically very similar to *L. lacertosus* and perhaps may be synonymous with the latter species, as suggested by J. Forest and M. de Saint Laurent (pers. comm. to John Yaldwyn). The former species is known only from its holotype collected south-west of Three Kings Islands off the northern tip of New Zealand (c. 34.2°S). *Lophopagurus lacertosus* is a highly variable species, and in most morphological characters the holotype of *L. crenatus* falls within the range of these variations. However, none of the numerous specimens of *L. lacertosus* we have examined have exhibited the coalesced tuberculate armature of the dactyl and fixed finger of the right chela that is present in *L. crenatus*. In view of the striking development of tubercles seen in *L. nodulosus*, it is possible that this is truly a distinguishing character, therefore we prefer, at least for the present, to recognize *L. crenatus* as a distinct taxon. *Lophopagurus crenatus* is distinguished from *L. nanus* by the presence of a row of spines on the carpus of the 2nd right pereopod in the former species.

Remarks. In his description of the single male specimen collected during the "Terra Nova" expedition, Borradaile (1916) described the carpi of the pereopods as being armed with a single dorsodistal spine. An examination of the type has shown that to be inaccurate. The carpus of the right 2nd pereopod is armed with a row of spines.

As previously noted, Probert et al. (1979) mistook specimens of *L. nodulosus* sp. nov. as *L. crenatus*. Had Borradaile's (1916) description been more accurate regarding the armature of the carpus of the right 2nd pereopod or more detailed in a description of the shape of the dactyl of the 3rd left pereopod, these authors would undoubtedly have realized that their species was distinct from *L. crenatus*.

Lophopagurus lacertosus (Henderson, 1888)

Figure 6

Eupagurus lacertosus Henderson, 1888: 63, pl. 6 fig. 7. — Thomson, 1898 : 178 (in part, see remarks). Sayce, 1902: 153. — Grant (in Sayce), 1902: 155. — Alcock, 1905: 175. — Zarenkov, 1967: 182 (in part), see remarks.

Pagurus lacertosus. — McCulloch, 1913: 346. — Gordan, 1956: 311 (in part), see remarks.

? *Pagurus* cf. *lacertosus*. — Yaldwyn, 1975: 361.

Pylopagurus lacertosus. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 3.

Lophopagurus lacertosus. — McLaughlin, 1981a: 3 (by implication).

Not *Eupagurus lacertosus*. — Pope, 1947: 131, unnumbered figs 3, 4. — Dakin et al., 1948: 209, 219. — 1953: 199, pl. 44 fig. 7. — 1960: 199, pl. 44 fig. 7 (= *Pagurixus jerviensis* McLaughlin and Haig, 1984).

Not *Pagurus lacertosus*. — Griffin, 1967: 306. — Healy and Yaldwyn, 1970: 72, fig. 35 (= *Pagurixus jerviensis* McLaughlin and Haig, 1984).

Not *Pagurus lacertosus*. — Forest, 1961: 223 [= *Lophopagurus thompsoni* (Filhol)].

? Not *Pagurus lacertosus*.– Liszka and Underwood, 1990: 47 (? = *Pagurixus jerviensis* McLaughlin and Haig, 1984), see remarks.

Type Material. Lectotype herein selected: Type locality, HMS "*Challenger*" stn 166, off New Zealand, BMNH 88:33 (male 9.6 mm).

Other Material. RV *Tangaroa*, NZOI stn R 81 (37°35.9′S, 176°59.5′E), 139–179 m, 20 Jan 1979 NMNZ Cr8243 (1 female, 2.3 mm). USNS *Eltanin* stn 24/2718 (38°22′S, 169°07′W), 531–656 m, 12 Jul 1966, USNM 244461 (9 males, 1 female, 2 ovigerous females, 4.3–9.2 mm). Challenger Plateau (39°14′S, 169°27′E), 560–572 m, 21 Sep 1976, NMNZ Cr4905 (1 male, 6.9 mm). RV *Acheron* stn BS 519, Cook Strait Narrows (41°02′S, 174°33′E), 186–256 m, 6 Mar 1976, NMNZ Cr4908 (1 female, 2.2 mm). Off Cape Turakirae (41°30.2′S, 174°52′E), 658 m, 11 Dec 1974, NMNZ Cr7527 (1 male, 7.8 mm). RV *Tangaroa* NZOI stn R 27, SE of Cape Campbell (41°55.8′S, 174°40.7′E), 434–446 m, 14 Jan 1979, NMNZ Cr4907 (1 ovigerous female, 6.6 mm). RV "*James Cook*" stn J22/60/70, off Greymouth (42°27′S, 170°36′E), 440–460 m, 23 Nov 1970, NMNZ Cr4909 (6 males, 2 females, 5.0–11.8 mm). RV *Acheron* stn BS 433, Taiaroa Trench off Otago Peninsula, A.J. Black, 723–769 m, 11 Aug 1974, NMNZ Cr4902 (1 male, 5 ovigerous females, 4.7–6.9 mm). RV *Acheron* stn BS 558, head of Pegasus Canyon (43°30′S, 173°31.5′E), 446 m, 27 Sep 1976, NMNZ Cr4906 (2 males, 1 female, 4.1–9.0 mm). RV *Acheron* stn BS 549, head of Karitane Canyon (45°38.5′E, 171°05′E), 530–585 m, 19 Mar 1976, NMNZ Cr4904 (1 female, 4.4 mm). RV "*Munida*" stn 76/139, Papanui Canyon NE of Taiaroa Head (45°46′S 171°03′E), 660 m, 1 Sep 1976, NMNZ Cr8170 (1 male, 5.7 mm). USNS *Eltanin* stn 33/2145 (49°07′S,

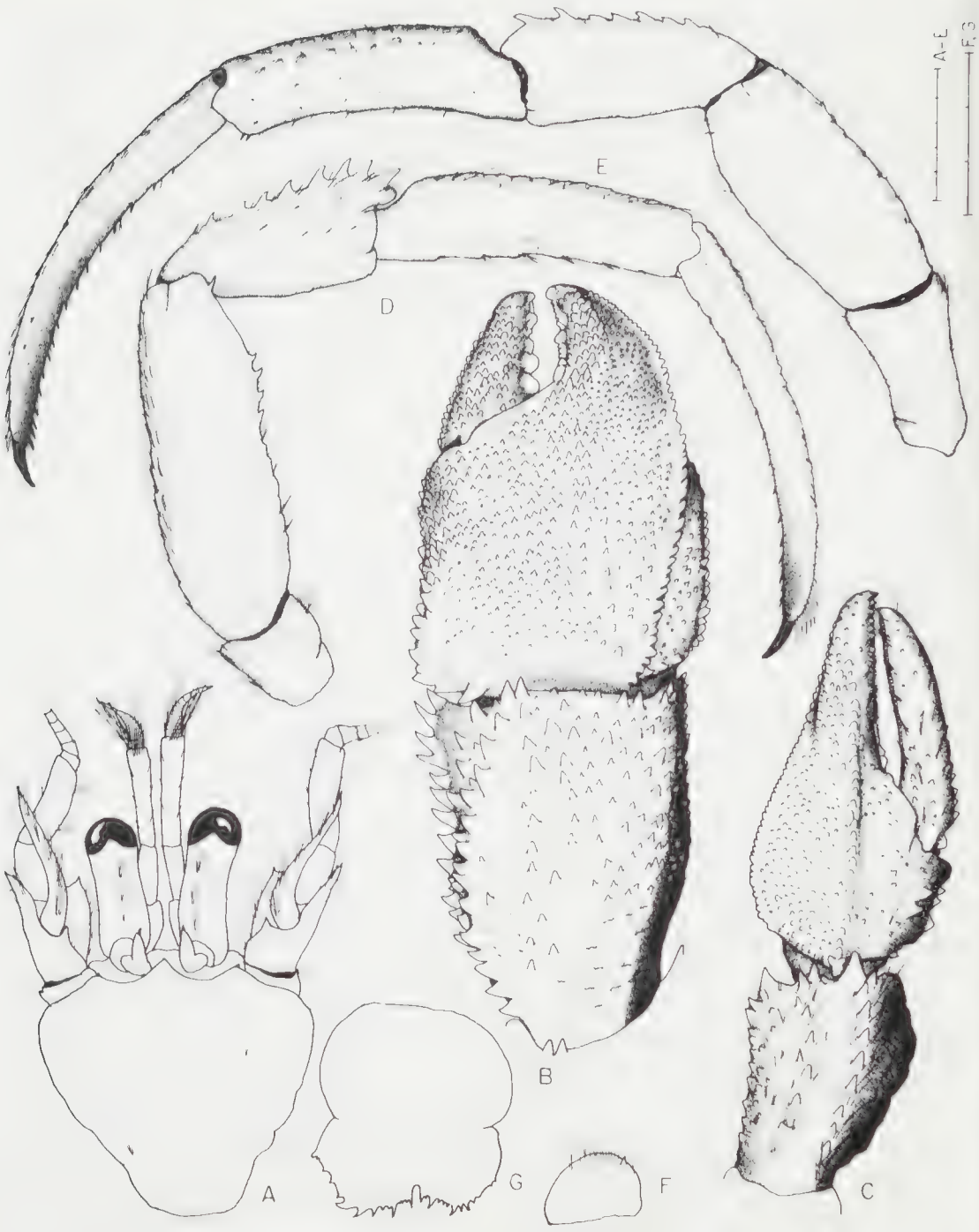


Figure 6. *Lophopagurus lacertosus* (Henderson), lectotype, from *Challenger* stn 166, off New Zealand, BMNH 88:33. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd percopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scales = 5 mm (A–E) and 3 mm (F, G).

172°00′E), 384–397 m, 23 Mar 1968, NHRM 16679, RMNH D 40427 (4 males, 3 females, 4.7–7.2 mm). USNS *Eltanin* stn 16/1426 (51°05′S, 166°22′E), 428–439 m, 19 Feb 1965, USNM 244452 (1 male, 6.0 mm). East Campbell Is. Rise (51°47′S, 168°19′E), 687–695 m, 19 Jan 1977, NMNZ Cr4903 (1 male, 1 ovigerous female, 6.2, 7.6 mm). USNS *Eltanin* stn 32/1989 (53°29′S, 169°48′E), 589–594 m, 1 Jan 1968, USNM 244454 (1 male, 3 females, 4.9–5.9 mm).

Redescription. Shield slightly broader than long to longer than broad; anterior margin between rostrum and lateral projections concave. Rostrum obtusely triangular, acute or bluntly rounded, sometimes terminating in minute spinule. Lateral projections broadly rounded, with 1 or occasionally 2 submarginal spinules.

Ocular peduncles ½–⅔ length of shield, moderately stout, with corneae slightly dilated; dorsomesial surface with row of tufts of setae. Ocular acicles narrowly and acutely triangular, with strong submarginal spine; separated basally by slightly less to slightly more than basal width of 1 acicle.

Antennular peduncles overreach ocular peduncles by almost entire length of ultimate segment. Ultimate segment with tuft of setae at dorsodistal margin and 2 rows of widely-spaced tufts of setae on dorsal surface.

Antennal peduncles overreach ocular peduncles by ½–⅔ length of ultimate segment. Fifth and fourth segments with scattered tufts of setae. Third segment with strong spine at ventrodistal angle. Second segment with dorsolateral distal angle produced and terminating in strong spine, mesial margin with 2 to several small spines; dorsomesial distal angle with strong spine. First segment with small spine at laterodistal margin. Antennal acicle considerably longer than ocular peduncles, reaching beyond proximal half of ultimate peduncular segment. Antennal flagella usually not overreaching right cheliped; 1–3 very short setae every 1 to several articles.

Right cheliped with dactyl slightly shorter to slightly longer than palm. Dactyl triangular and slightly elevated in midline, dorsal surface often covered with low, sometimes spinulose protuberances or tubercles, less prominent in large males; dorsomesial margin with row of closely-spaced small tubercles. Palm ¾–⅘ length of carpus; dorsomesial margin depressed and armed with single or double row of small spines or tubercles, dorsomesial component weakly concave, armed with low, blunt or spinulose tubercles and delimited dorsally by moderately broad spinulose or tuberculate ridge; dorsal surface often covered with low, blunt or spinulose tubercles, sometimes only granules, occasionally almost smooth, dorsal midline with single or double row of somewhat stronger spines, spinules or tubercles; fixed finger with narrow to broad ridge of blunt or spinulose tubercles near cutting edge and frequently also small spinules or tubercles on dorsal surface laterally; dorsolateral margin with row of blunt or acute spines or tubercles, lateral surface convex or angular, often covered with blunt to spinulose tubercles or granules and frequently with 1 stronger row of tubercles, also scattered tufts of setae. Carpus slightly longer than merus; dorsomesial margin with double or triple row of strong spines becoming widely divergent in distal half, dorsal midline with 1 or 2 rows of acute, smaller spines, dorsal surface laterad of midline with numerous small spines or spinulose tubercles, distal margin with few spines; lateral face spinulose or tuberculate and with tufts of setae, ventrolateral margin with row of blunt or acute spines or tubercles. Merus with 1 or 2 strong spines at dorsodistal margin, dorsal surface with transverse rows of long setae, extending onto lateral and mesial faces; ventrolateral margin with row of acute spines, ventromesial margin with 2 or 3 spines in proximal half. Ischium with row of small spines on ventromesial margin, laterodistal margin with small spine and tufts of setae ventrally.

Left cheliped with dactyl 2½–3½ times longer than palm; dorsal surface of dactyl with 1 or 2 rows of tufts of setae and sometimes also low protuberances or tubercles in proximal half, dorsomesial margin unarmed or with row of small spines or spinulose tubercles in proximal half. Palm ⅓–½ length of carpus; strongly elevated in dorsal midline and armed with row of small spines or tubercles extending onto fixed finger, dorsolateral margin with closely-spaced, compressed tubercles, dorsolateral surface unarmed or with minute to moderately well-defined, blunt or spinulose tubercles, dorsomesial surface with scattered small spines or spinules, dorsomesial margin with row of broad, sometimes spinulose tubercles. Carpus slightly longer than merus; dorsolateral margin with row of spines, strongest at distal angle, dorsomesial margin usually with row of smaller spines and transverse rows of long setae; lateral face frequently spinulose dorsally and with 1 or 2 strong spines near distal margin, spinulose protuberances or small spines ventrally, ventrolateral margin with row of spinules or spines. Merus with row of tufts of stiff setae on dorsodistal margin, dorsal surface with several transverse rows of stiff setae

extending onto lateral and mesial faces; ventrolateral margin with row of strong acute spines, ventromesial margin with 2 or 3 strong spines in proximal half. Ischium with row of small spines on ventromesial margin; laterodistal margin sometimes with 1 spine ventrally obscured by tuft of setae.

Ambulatory legs generally similar from right to left, or dactyl of left 3rd slightly different. Dactyls in dorsal view strongly twisted; in lateral view, slightly curved ventrally; usually at least 1½ times length of propodi; dorsal margins with transverse rows of stiff setae, mesial faces each with dorsal and ventral row of corneous spinules or stiff setae, ventral margins each with row of 11–21 corneous spinules; lateral faces often with median longitudinal sulcus and sometimes dorsal row of low protuberances in males, frequently lateral face slightly concave in females. Propodi slightly longer than carpi; dorsal surfaces with transverse, sometimes spinulose, ridges and tufts of setae, ventral surfaces with transverse ridges and short to long setae. Carpi ½–⅔ length of meri; dorsal surfaces of 2nd (occasionally only right) and frequently also 3rd each with row of strong spines, slightly less prominent on 3rd. Meri with transverse ridges and tufts of setae on dorsal surfaces, ventral margins each with row of spines, at least in distal half (2nd), or low protuberances (3rd) and tufts of setae. Ischia with tufts of setae on ventromesial margin.

Anterior lobe of sternite of 3rd pereopods subsemicircular, anterior margin with long setae and sometimes 1 or 2 small spinules. Fourth pereopod with small preungual process at base of claw. Telson with posterior lobes oblique or rounded, terminal margins with few strong spines and numerous smaller spines extending onto lateral margins.

Colour. Unknown.

Distribution. Eastern New Zealand from off Motuhora Island to Otago, western New Zealand and Tasman Sea, and Campbell Island; ? Auckland Island (Yaldwyn, 1975); 139–840 m.

Affinities. As indicated in the discussion of *L. crenatus*, given the ranges of variation of several morphological characters observed in *L. lacertosus* the possibility exists that this species is conspecific with, and the senior subjective synonym of, *L. crenatus*. The two taxa presently are distinguished by the armature of the dactyl and fixed finger of the right chela, which are armed with spinules, small tubercles or small spines in *L. lacertosus* in contrast to a broad row of coalesced tubercles in *L. crenatus*.

Despite the fact that Henderson (1888) considered *L. lacertosus* morphologically very close to *L. nanus*, this species actually is more readily confused with *L. thompsoni*. *Lophopagurus thompsoni* shares distributional and morphological attributes with *L. lacertosus*. Both species have the carpi of the second, and usually also the third pereopods armed with a dorsal row of spines. *Lophopagurus nanus*, in contrast, has only one spine at the dorsodistal margin of these segments. *Lophopagurus lacertosus* is readily distinguished from *L. thompsoni* by the dactyl of the 3rd left pereopod. The dactyl of *L. lacertosus* is generally similar in size and shape to that of the left 2nd. The lateral surface is flattened, very faintly concave, or even convex and frequently is marked by a longitudinal sulcus in the proximal third. In *L. thompsoni* the dactyl of the left 3rd pereopod is short, broad and distinctly different from the 2nd; the lateral face is markedly concave.

Remarks. Henderson (1888) considered *L. nanus* to be only a dwarf variety of *L. lacertosus*, and for this reason in some subsequent reports, authors (e.g., Thomson, 1898; McCulloch, 1913; Zarenkov, 1967) combined the two taxa. Forest and de Saint Laurent (1967) elevated the former to full specific rank when they transferred it, together with *L. lacertosus*, to the genus *Pylopagurus*. We concur that both represent distinct taxa.

A common intertidal hermit crab found in and around Sydney, Australia has frequently been referred to as *Pagurus* (or *Eupagurus*) *lacertosus* (i.e., Pope, 1947; Dakin et al., 1948, 1953, 1960; Griffin, 1967; Healy and Yaldwyn, 1970). This species was recently described as *Pagurixus jerviensis* McLaughlin and Haig, a species bearing only gross similarities to Henderson's taxon (McLaughlin and Haig, 1984). Liszka and Underwood (1990), in a study of gastropod preference, state that their study animal was *Pagurus lacertosus*, a small crab abundant in the intertidal and subtidal habitats in the Sydney region. Acknowledgement for taxonomic identification is given to the Australian Museum and "Dakin (1953)" (for Dakin et al., 1953) is cited for ecological information. Their material was not deposited in the Australian Museum and consequently is not available for reexamination (P.B. Berents, pers. comm.). In view of the common misidentification that has so frequently

been made of one local intertidal species, we questionably assign Liszka and Underwood's (1990) taxon to *Pagurixus jerviensis*.

In his checklist of decapod and stomatopod Crustacea from the Auckland and Campbell Islands, Yaldwyn (1975) included *Pagurus* cf. *lacertosus* (Henderson), with the accompanying note that according to Pike (1961) *P. lacertosus* and *P. thompsoni* were synonymous. The identity of Yaldwyn's specimen(s) has not been determined; however, currently available distributional records do not indicate that *L. thompsoni* is found as far south as the Subantarctic, whereas *L. lacertosus* is.

Lophopagurus nanus (Henderson, 1888)

Figures 1B, D, F; 7

Eupagurus lacertosus var. *nana* Henderson, 1888: 64, pl. VII fig. 1. — Ortmann, 1892: 306. — Whitelegge, 1889: 231. — 1900: 169. — Alcock, 1905: 175.

Eupagurus lacertosus, var. *Nana*. — Grant (in Sayce), 1902: 155.

Pagurus lacertosus var. *nana*. — McCulloch, 1913: 346.

Pagurus nana. — Hale, 1927: 94, fig. 90.

Eupagurus lacertosus nana. — Hale, 1941: 279.

Pylopagurus nanus. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 3.

Eupagurus lacertosus. — Zarenkov, 1967: 182 (in part) (see remarks).

Lophopagurus nanus. — McLaughlin, 1981a: 3 (by implication).

Type material. Syntypes: HMS "*Challenger*" stn 162, off East Moncoeur Island, Bass Strait, BMNH 88:33 (4 males, 1.8–3.3 mm; 1 female, 2.0 mm, 1 ovigerous female, 1.7 mm).

Other material. Australia, Qld. 20 mi NNE of Double Island Pt, AM E6277 (4 males, 6 ovigerous females, 1.5–2.6 mm). Off coast of NSW, 128 m, USNM 64543 (3 males, 1 female, 1 ovigerous female, 1.6–2.4 mm). HMAS "*Kimbla*" stn K7/73-57 (38°18.6' S, 146°40.8'E), 64 m, 25 Nov 1973, NMV J11761 (1 ovigerous female, 2.9 mm). HMAS "*Kimbla*" stn K7/73-62 (39°00.3'S, 146°45.9'E), 66 m, 26 Nov 1973, NMV J11383 (1 male, 4.1 mm). ¼ mi. off Newhaven, Western Port, Vic., T. Crawford, 6 Apr 1963, NMV J14597 (1 female, 1.9 mm). Simpsons Bay, Tasmania, 14–27 m, Jul 1926, USNM 64596 (1 male, 5.4 mm). Simpsons Bay, D'Entrecasteaux Channel (43°17.7'S, 147°18'E), M. Ward, 14–22 m, Aug 1926, AM P8652 (1 male, 5.0 mm). Southeast Australia, NMV J14595 (1 male, 5.1 mm).

Redescription. Shield longer than broad; anterior margin between rostrum and lateral projections concave; posterior margin truncate. Rostrum broadly triangular, usually without terminal spinule. Lateral projections broadly rounded, with small terminal margin spinule.

Ocular peduncles ½–⅔ shield length, with corneae slightly inflated, dorsomesial face with row of tufts of stiff setae. Ocular acicles narrowly and acutely triangular, with moderately small submarginal spine; separated basally by slightly less to slightly more than basal width of 1 acicle.

Antennular peduncles when extended overreach ocular peduncles by ½–⅔ length of ultimate segment. Ultimate segment with tuft of setae adjacent to dorsodistal margin.

Antennal peduncles reaching to distal margin of corneae or slightly beyond. Fifth and fourth segments with few scattered setae. Third segment with small spine at ventrodistal margin, partially obscured by tuft of long, stiff setae. Second segment with dorsolateral distal angle produced, terminating in strong spine, mesial margin with 1–3 additional smaller spines, lateral margin usually with 1 additional spine and several long setae; dorsomesial distal angle with strong spine. First segment with spine at laterodistal margin. Antennal acicle reaching to distal margin of cornea or slightly beyond and terminating in strong spine; mesial margin with row of tufts of setae. Antennal flagellum with occasional short seta every several articles.

Right cheliped with dactyl slightly shorter than palm; terminating in corneous claw and slightly overlapped by fixed finger. Dorsal surface of dactyl with low, sometimes spinulose tubercles or protuberances and short setae, dorsomesial margin with row of small, sometimes spinulose tubercles, often becoming obsolete distally; mesial face and ventral surface with scattered tufts of setae. Palm ⅔–¾ length of carpus; dorsomesial margin depressed and armed with single or double row of small spinules, dorsomesial segment often with weakly tuberculate surface, delimited above by single or double row of small spinules or spinulose tubercles, dorsal surface of palm weakly tuberculate and with row of spinules or tubercles laterad of midline, fixed finger with dorsal surface weakly tuberculate and with longitudinal, tuberculate ridge adjacent to cutting edge developing in larger specimens (SL >2.5 mm), dorsolateral margin of palm and fixed finger with row of small spines or spinulose tubercles often decreasing in size proximally; lateral face convex and weakly tuberculate or with transverse ridges and scattered short setae, ventral surface also weakly tuberculate. Carpus approximately equaling length of merus; dorsomesial margin with row of acute spines and adjacent second, oblique row of


D
E
F
G
C
B
A

slightly smaller spines, dorsodistal margin with 1 or 2 small spines, dorsal surface with additional 1 or 2 rows of spines laterad of midline and transverse rows of tufts of setae, extending onto lateral surface, dorsolateral margin not delimited; ventrolateral margin often with row of small spinules distally, ventral and mesial surfaces with scattered tufts of setae. Merus usually with 1 acute spine at dorsodistal margin, dorsal margin with transverse ridges and tufts of long setae, extending onto lateral and mesial faces; ventrolateral margin with row of acute spines, strongest distally, ventromesial margin with 2 or 3 spines in proximal half. Ischium frequently with 1 or 2 spines on ventromesial margin proximally.

Left cheliped with dactyl 2½–3 times length of palm, terminating in strong corneous claw, overlapped by fixed finger; surfaces of dactyl with scattered tufts of setae. Palm 3¼–3½ times shorter than length of carpus; dorsal surface elevated in midline into prominent crest, armed with row of spines, becoming obsolete near tip of fixed finger, dorsolateral margin crenulate and depressed to ventral position distally on fixed finger, dorsolateral surface smooth, minutely tuberculate or with very low protuberances and tufts of setae, dorsomesial surface often with few low tubercles and numerous tufts of setae, dorsomesial margin with few low tubercles. Carpus approximately equaling length of merus; dorsal surface with somewhat oblique row of acute spines extending from dorsolateral margin proximally to dorsomesial margin distally, dorsomesial margin also often with 2 or 3 small spines or protuberances proximally, dorsodistal margin with 1 or 2 spines; mesial face with scattered tufts of setae; lateral face usually with 1 small spine on distal margin dorsally and 1 or 2 spines near distal margin ventrally, ventrolateral margin often with few small spinules or tubercles; ventral surface with numerous tufts of long setae. Merus with transverse ridges and tufts of long setae on dorsal surface and extending onto mesial and lateral faces; ventromesial margin with 1–3 blunt or acute spines proximally, ventrolateral margin with row of acute spines. Ischium usually with row of small spines on ventromesial margin.

Second and 3rd pereopods similar. Dactyls exceed length of propodi by ¼–⅓ own length; each terminating in strong corneous claw; dorsal surfaces with tufts of thick, sometimes spine-like bristles, lateral faces each with median longitudinal sulcus and tufts of setae dorsally and ventrally, mesial faces each with row of corneous spinules dorsally and ventrally; ventral margins each with row of 8-15 corneous spines. Propodi exceeding carpi by ⅓–½ own length; ventral distal angles each with 2 or 3 corneous spinules and row of corneous spinules on ventral surface, dorsal surfaces with tufts of setae. Carpi ½–¾ length of meri; dorsal surfaces with low protuberances and tufts of long setae, 1 or rarely 2 spines at dorsodistal margins. Meri with low protuberances and tufts of long setae on dorsal surfaces, ventral surfaces with tufts of setae or low protuberances proximally, often becoming small spinules distally (2nd) or with only tufts of setae (3rd). Ischia with tufts of setae dorsally and ventrally.

Sternite of third pereopods with anterior lobe subsemicircular, anterior margin with long setae. Fourth pereopod with small preungual process at base of claw. Telson with posterior lobes generally symmetrical; terminal margins oblique, each with 3 or 4 prominent spines and smaller spines extending onto lateral margins.

Colour. Unknown.

Affinities. Lophopagurus nanus is quite similar to *L. crenatus* in having a single row of spines on the carpus of the left cheliped. It differs from *L. crenatus* in lacking spines on the carpus of the 2nd right pereopod. *Lophopagurus nanus* also is superficially similar to *L. foresti*, but is immediately distinguished from that species by having the left 2nd and 3rd pereopods similar; the lateral face of the dactyl of the 3rd left is flattened or convex and often provided with a longitudinal sulcus. The left 2nd and 3rd pereopods of *L. foresti* are distinctly dissimilar; the lateral face of the dactyl of the 3rd is markedly concave.

Distribution. South-eastern Australia and Tasmania; 14–128 m.

Remarks. Hale (1927), without comment, elevated Henderson's var. *nana* to full specific rank

Figure 7. *Lophopagurus nanus* (Henderson), male syntype, from off East Moncoeur Island, Bass Strait, Australia, BMNH 88:33. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scale = 1 mm (A–E) and 0.5 mm (F, G).

as *Pagurus nana*; however, in his later publication (Hale, 1941) he again cited this taxon as a subspecies of *L. lacertosus*. Although Henderson (1888) described *L. nanus* as having the characters of *L. lacertosus* and differing only in size, the two taxa do exhibit significant morphological differences. This fact was recognized by Forest and de Saint Laurent (1967) when they transferred both species to *Pylopagurus*.

Lophopagurus nanus is abundant in the waters off southern Australia, and is represented in the collections of the Museum of Victoria by several hundred lots. These lots have been examined by one of us (S.W. Gunn) but, in the interest of conciseness, are not listed under materials examined.

Australeremus McLaughlin, 1981

Eupagurus sensu lato. — Melin, 1939: 29 (in part, see remarks).

Pylopagurus. — Forest and de Saint Laurent, 1967: 145 (in part), not *Pylopagurus* Milne Edwards and Bouvier, 1891. — Miyake, 1978: 119 (in part). — McLaughlin, 1981a: 2 (in part) see remarks.

Australeremus McLaughlin, 1981a: 4. Type species, by original designation, *Eupagurus cookii* Filhol. Gender masculine.

Diagnosis. Eleven pairs phyllobranch gills. Ocular acicles triangular, with well developed submarginal spine; separated basally by ½ to entire basal width of 1 acicle. Sternite of 3rd maxillipeds usually with small spine or spinule on either side of midline. Basal antennular segment with strong lateral spine; ventrodistal margin produced into elongate lobe. Maxillule (Fig. 8A, B) with external lobe of endopod well developed, internal lobe with 1 or 2 terminal bristles. Maxilla with proximal lobe of scaphognathite narrow (Fig. 8C, D). First maxilliped (Fig. 8E, F) with exopod slender to slightly broadened basally. Third maxilliped with well developed crista dentata and very strong accessory tooth; merus with or without small spine at dorsodistal margin, carpus unarmed.

Right cheliped often not appreciably larger than left. Chela of right subrectangular to subtriangular; dorsal surface of palm circumscribed by row of dorsomesial, dorsoproximal and dorsolateral marginal spines; angle of propodal-carpal articulation approximately 15° from horizontal plane. Left chela with dactyl elongate and considerably narrower than fixed finger; dorsolateral margin of chela elevated, at least proximally, and frequently expanded; angle of propodal-carpal articulation variable. Sternite of 3rd pereopods with semisubcircular, subovate or slender rod-like anterior lobe. Fourth pereopods with propodal rasp consisting of single row of corneous scales; dactyl with very to moderately short claw and minute preungual process at base.

Abdomen frequently straight or only weakly flexed. Uropods symmetrical or asymmetrical. Telson with transverse suture; posterior lobes symmetrical or subequal, terminal margins straight, oblique or rounded, armed with 1–4 strong, often blunt spines and few smaller spines or spinules, lateral margins each with undifferentiated, usually weakly calcified plate. Males without paired pleopods, with 3 unequally biramous pleopods. Females with paired 1st pleopods modified as gonopods, with 4 unpaired biramous pleopods, 2nd–4th with both rami well developed, 5th with endopod reduced.

Distribution. Japan, Bonin Islands, East China Sea; New Zealand; 12–300 metres.

Etymology. From the Latin *australis*, meaning southern and *eremus* a hermit.

Remarks. Melin (1939) subdivided *Eupagurus* Brandt into a number of subgenera, among them the nominal subgenus *Eupagurus*. In this taxon, Melin mentioned only *Eupagurus* (*Eupagurus*) *triserratus* Ortmann. Although Melin had both male and female specimens of this species at his disposal, he apparently overlooked the presence of paired first pleopods in the females.

Forest and de Saint Laurent (1968) provided a diagnosis of *Pylopagurus* based on Milne Edwards and Bouvier's (1893) description of the genus. However, in their original generic diagnosis Milne Edwards and Bouvier (1891) included only two species, *Pylopagurus discoidalis* (A. Milne Edwards) and *P. ungulatus* (Studer). Neither of these species was mentioned by Forest and de Saint Laurent (1968) in their discussion. Miyake (1978) designated *P. discoidalis* as the type of the genus; however, the only other species cited was the Japanese *P. serpulophilus*, a species we believe to be the junior subjective synonym of *A. triserratus*.

In the initial diagnoses of pylopagurid-like genera (McLaughlin, 1981a), the key character employed to distinguish *Pylopagurus* sensu stricto from other genera, including *Australeremus*, was uropod symmetry. Specimens of *A. cookii* available at the time all had coiled abdomens, suggestive of gastropod shell usage. In all cases the uropods were markedly asymmetrical. In contrast, available specimens of *P. stewarti*

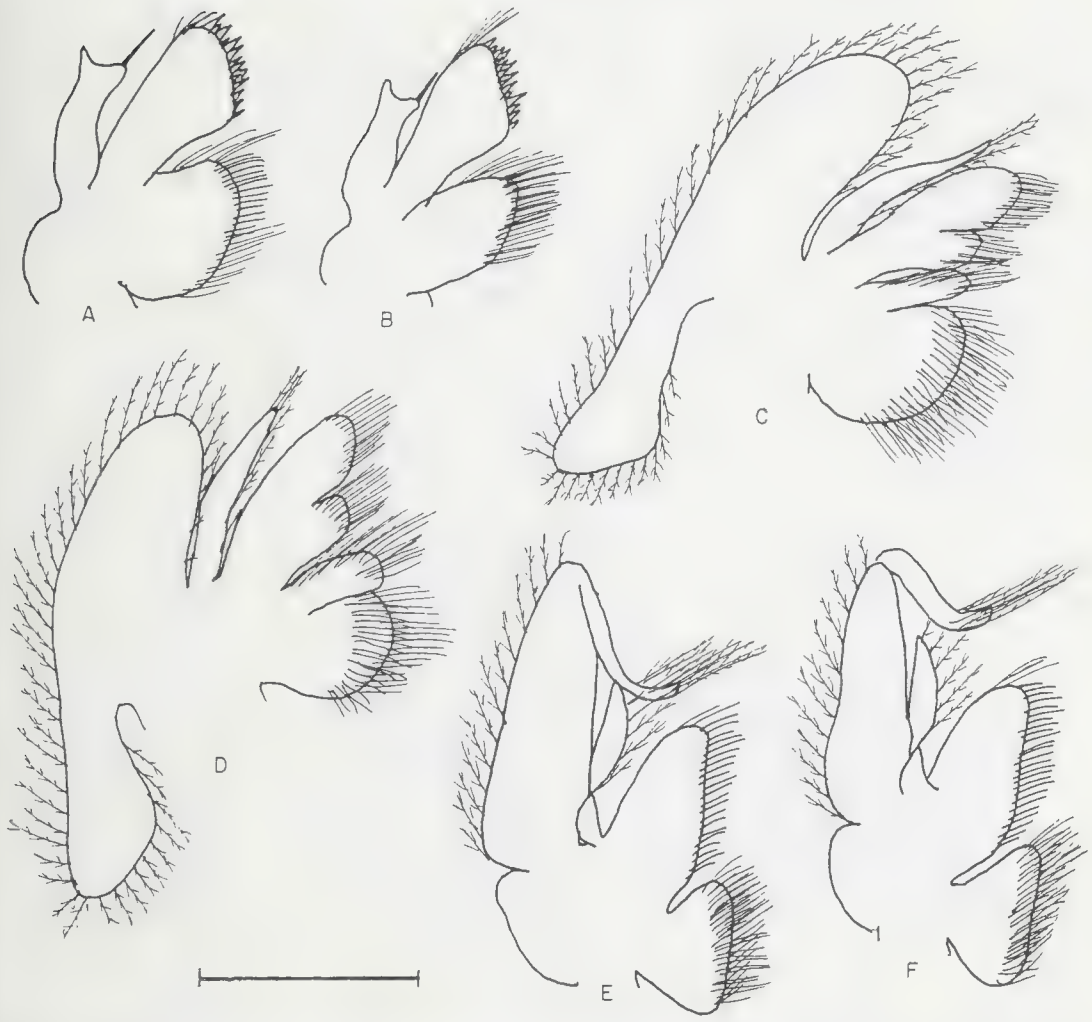


Figure 8. *Australeremus*. A, C, E, *A. laurentae* sp. nov., A, maxillule; C, maxilla; E, first maxilliped. B, D, F, *A. stewarti* (Filhol), B, maxillule; D, maxilla, F, first maxilliped. Scale = 1.0 mm (A, C, E) and 0.5 mm (B, D, F).

had elongate, straight abdomens that suggested scaphopod shell or worm tube usage. The uropods of these specimens were uniformly symmetrical. We have now had the opportunity to examine representatives of *A. cookii* removed from serpulid worm tubes. The uropods of these specimens vary from slightly asymmetrical to entirely symmetrical. Quite obviously, uropod symmetry, at least in *A. cookii*, is strongly influenced by habitat selection. *Pylopagurus* s.s. is more reliably distinguished from *Australeremus* by the shape and/or armature of the chelae: the dorsolateral margin of the left chela level or depressed and unarmed or minutely spinulose in *Pylopagurus* but elevated, often inflated, and strongly spinose in *Australeremus*. The dorsomesial, dorsoproximal and dorsolateral margins of the right chela, although distinctly circumscribing the palm in both genera, are unarmed in *Pylopagurus* but spinose in *Australeremus*.

With the present emendation of the generic diagnosis of *Australeremus*, it becomes clear that *Pylopagurus stewarti* shares more generic characters with species of *Australeremus* than with *Pylopagurus* s.s. and is transferred herein to the former genus. McLaughlin's retention of *P. serpulophilus* in *Pylopagurus* was based entirely on Miyake's (1978) description and illustration.

We have now had the opportunity to examine specimens of Ortmann's (1892) *Eupagurus triserratus*, a species we believe to be the senior subjective synonym of Miyake's (1978) taxon, and find that it too should be assigned to *Australeremus*.

As among species of *Lophopagurus*, intrageneric similarities and intraspecific variations are common in species of *Australeremus*. Similarities include the usually marked rotation of the propodal-carpal articulation of the left chela, and in *A. cookii*, *A. kirkii*, and *A. cristatus* a prominent patch of red on the dorsal surfaces of the chelae at the point of articulation of dactyl and fixed finger. Intraspecific variations involve, among others, the strength of the armature of the chelae, observed particularly in *A. stewarti* and *A. eltaninae*; the armature of the dactyls and propodi of the ambulatory legs, which varies from unarmed to strongly spinose dorsal margins in *A. cookii*; and size-related carpal length-width ratios of *A. stewarti*. *Australeremus cookii*, *A. laurentae* n. sp., and *A. stewarti* commonly inhabit bryozan tubes (Taylor et al., 1989, PMcL pers. obs), whereas *A. triserratus* is often found in serpulid worm tubes. Habitat has been found to strongly affect uropod symmetry, at least in the case of *A. cookii*.

Key to species of *Australeremus*

1. Dorsal surfaces of chelae covered with closely-spaced, flattened tubercles 2
— Dorsal surfaces of chelae with spines or well developed tubercles ... 3
2. Ventrolateral margin of carpus of right cheliped armed with row of spines or spinules; ventral margins of meri of 2nd pereopods each with several spines ..... *A. cookii*
— Ventrolateral margin of carpus of right cheliped unarmed; ventral margins of meri of 2nd pereopods unarmed ..... *A. laurentae*
3. Dorsal margins of propodi of 3rd pereopods each with row of spines ..... *A. cristatus*
— Dorsal margins of propodi of 3rd pereopods without row of spines . 4
4. Dorsal margins of carpi of 2nd pereopods each with row of spines (dactyls with 13–17 corneous spines on ventral margins) .... *A. kirkii*
— Dorsal margins of carpi of 2nd pereopods only with spine at dorsodistal angle and occasionally 1 spine in proximal half 5
5. Dorsal margins of dactyls of ambulatory legs unarmed .. *A. triserratus*
— Dorsal margins of dactyls of 2nd pereopods with spines or protuberances 6
6. Right cheliped (dorsal view) with chela rectangular, carpus width $< \frac{1}{2}$ length; ventrolateral margin of merus of left cheliped unarmed or with 1 small spine at distal angle ..... *A. stewarti*
— Right cheliped (dorsal view) with chela subtriangular, carpus width $> \frac{2}{3}$ length; ventrolateral margin of merus of left cheliped with row of acute spines in distal half ..... *A. eltaninae*

Australeremus cookii (Filhol)

Figures 9

Eupagurus Cookii Filhol, 1883: 67. — 1885b: 417, pl. 51 fig. 2.

Eupagurus cookii. — Thomson, 1898: 176 (? in part), ? pl. 20 figs 11–13 (see remarks). — Alcock, 1905: 176 (list). — Chilton, 1911: 299. — Thompson, 1930: 270 (? in part, see remarks).

?*Eupagurus stewarti*. — Chilton, 1911: 298 (in part, see remarks under *A. stewarti*).

Pagurus cookii. — Gordan, 1956: 328 (list).

Pylopagurus cooki. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 4.

?"a hermit crab". — Morton and Miller, 1968: 577, fig. 215 (2) (see remarks under *A. stewarti*).

? *Pylopagurus cooki*. — Batham, 1969: 79. — Probert et al., 1979: 381, 388 (list) (see remarks).

? *Pagurus cooki*. — Rainer, 1981: 37 (see remarks).

Australeremus cooki. — McLaughlin, 1981a: 4 (by implication). — Schembri and McLay, 1983: 31 (in part), figs 10a, b, 11 (see remarks).

? *Australeremus cooki*. — Schembri, 1982: 865, figs 6, 7. — 1988: 93 (list). — Probert and Wilson, 1984: 389 (list). — Taylor et al., 1989: 1064 (see remarks).

Holotype. Not seen.

Material examined. USNS *Eltanin* stn 23/1716 (37°35'S, 178°46'E), 128–146 m, 28 May 1966, USNM 244442 (1 female, 3.8 mm). RV *Tangaroa*, NZOI stn R

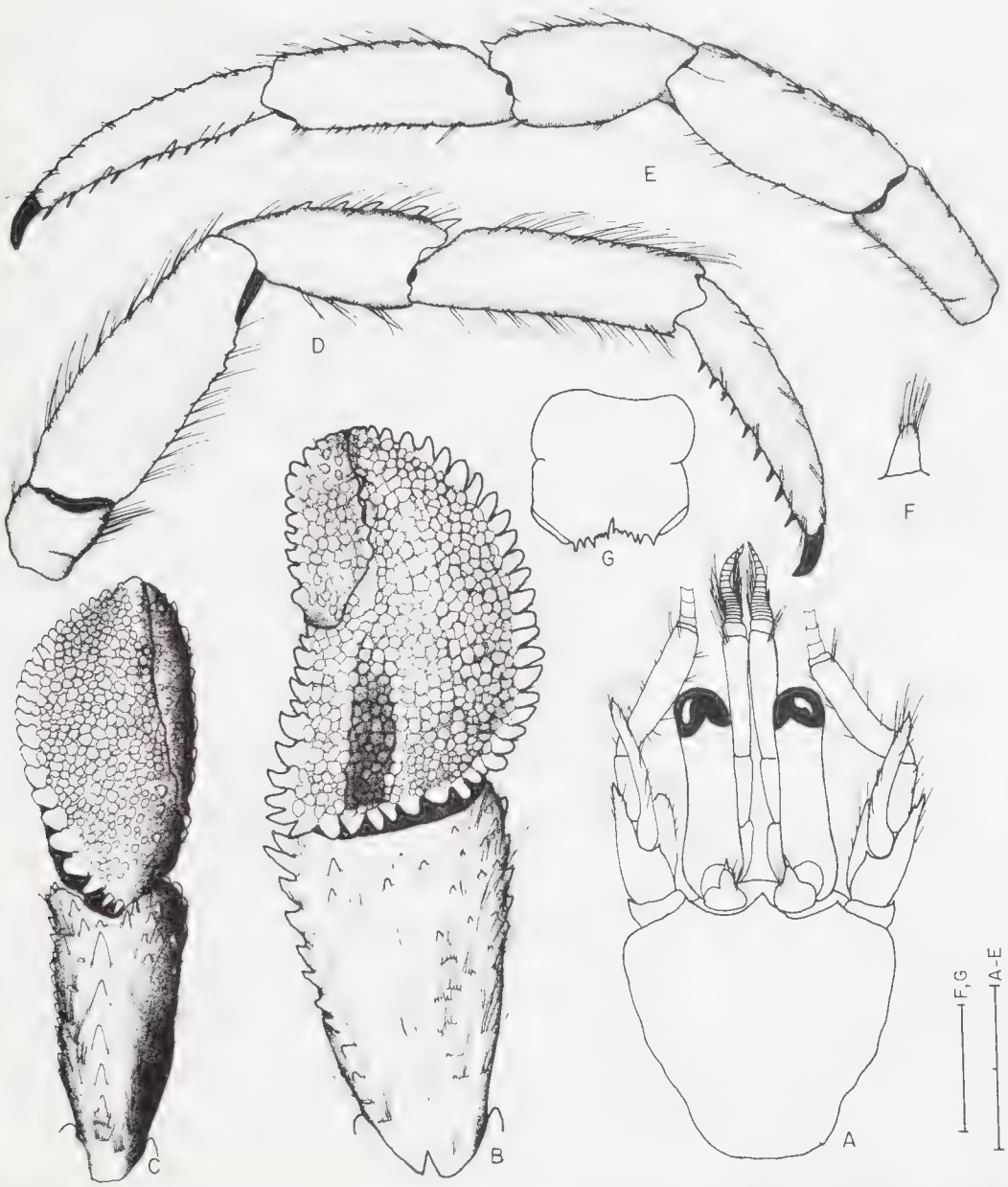


Figure 9. *Australeremus cookii* (Filhol), male from *Eltanin* stn 16/1431, USNM 244441. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scales = 2 mm (A–E) and 1 mm (F, G).

81, approximately 28 km N of Motuhora I. (37°35.9′S, 176°59.5′E), 139-179 m, 20 Jan 1979, NMNZ Cr7403 (2 males, 1.7, 3.4 mm). RV *Acheron* stn BS 505 (40°47′S, 174°10.5′E), 73 m, 4 Mar 1976, NMNZ Cr8348 (4 males, 2 females, 2.2–5.0 mm). RV *Tangaroa*, NZOI stn R 30 (41°31.4′S, 174°52.6′E), 255–553 m, 15 Jun 1979, NMNZ Cr7403 (1 male, 2.8 mm). USNS *Eltanin* stn 23/1709 (43°31′S, 176°10′W), 143–186 m, May 24, 1966, USNM 244440 (1 male, 3.1 mm). USNS *Eltanin* stn 16/1431 (45°37′S, 170°58′E), 51 m, 23 Feb 1965, USNM 244441 (3 males, 2 females, 2.8–3.7 mm). Mid-shelf off Otago Peninsula, P.J. Schembri, PML (13 males, 9 females, 1.9–5.0 mm). Dunedin, G.M. Thomson, AM G2127 (2 males, 2 females, 3.9–4.7 mm).

Redescription. Shield as long or longer than broad; anterior margin between rostrum and lateral projections concave; posterior margin truncate. Rostrum broadly triangular, terminating acutely. Lateral projections obtusely triangular, with small terminal spinule. Posterior carapace with tufts of setae adjacent to cervical groove.

Ocular peduncles ¾–⅘ length of shield, corneae slightly dilated. Ocular acicles narrowly triangular, terminating subacutely and with strong submarginal spine; separated basally by ¾– slightly more than basal width of 1 acicle.

Antennular peduncles when extended overreaching ocular peduncles by ½–¾ length of ultimate segment. Ultimate segment with 3 or 4 long setae at dorsolateral distal margin.

Antennal peduncles overreaching corneae by ¼–½ length of ultimate segment. Fifth and fourth segments with scattered setae dorsally and ventrally. Third segment with ventrodistal angle unarmed or with small spinule on ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in acute spine, mesial margin with 2–5 accessory spines; dorsomesial distal angle with acute spine. First segment with small spine or spinule on lateral distal margin. Antennal acicle somewhat arcuate, reaching proximal third to half of ultimate peduncular segment. Flagella with 2–4 long (>4 articles length) and 1 or 2 short setae every, or every second article, at least in proximal ⅔.

Right cheliped with dactyl slightly longer than palm; terminating in corneous claw and overlapped by fixed finger. Dorsal surface of dactyl covered almost completely with flattened tubercles, dorsomesial margin with row of compressed, blunt spines and few tufts of setae. Palm ½–⅔ length of carpus; dorsomesial, dorsoproximal and dorsolateral margins, each with row of compressed, blunt or acute spines, jointed to completely circumscribe palm and fixed finger, dorsal surface of palm and fixed finger covered with flattened tubercles, midline slightly elevated to form low broad ridge, extending complete length of fixed finger, dorsomesial face of palm marked by deep, rectangular depressed area, dorsolateral surface sloping to dorsolateral margin. Carpus with row of acute spines on dorsomesial margin, dorsolateral margin not distinctly delimited, dorsal surface flattened and with few scattered spinules and spinulose ridges, some extending onto lateral face dorsally; ventrolateral margin with row of small, blunt spines or spinules; mesial face concave, particularly in larger specimens. Merus approximately ⅔ length of carpus; dorsodistal margin with 1 acute spine, dorsal surface with transverse rows of tufts of setae; ventromesial and ventrolateral margins each with row of spines. Ischium with row of spinules on ventromesial margin.

Left cheliped somewhat shorter than right, but nearly as massive; propodal-carpal angle of articulation 80°–90° from horizontal plane. Dactyl 3–4 times length of palm; terminating in corneous claw and overlapped by fixed finger. Dorsal surface of dactyl often with double row of small granules or protuberances near cutting edge, dorsomesial margin with row of small spinules or tubercles and few setae. Palm with dorsolateral margin expanded, strongly elevated proximally but becoming ventral in position distally on fixed finger, armed with row of strong, compressed, somewhat blunted spines, dorsolateral surface covered with low, flattened tubercles, dorsomesial surface unarmed or with scattered small tubercles, dorsomesial margin with few low spinulose protuberances or blunt spines. Carpus subtriangular in cross-section; dorsal surface with row of acute spines laterally and tufts of moderately long setae; ventrolateral margin sometimes with 2 or 3 blunt spines or tubercles distally; mesiodistal margin frequently with few to several spines. Merus with transverse ridges and tufts of setae on dorsal margin; ventrolateral margin with row of acute spines, strongest distally, ventromesial margin with row of spines, strongest proximally. Ischium with row of spinules on ventromesial margin.

Ambulatory legs generally similar from right to left. Dactyls slightly shorter (2nd) to slightly longer (3rd) than propodi; dorsal margins each with row of low protuberances, sometimes developed into distinct spines in large individuals (SL > 4.5 mm), and tufts of moderate to long setae, lateral faces often with faint longitudinal sulcus, mesial faces of 2nd unarmed or with dorsal row of corneous spinules, 3rd with dorsal and ventral rows of widely-spaced corneous spinules, ventral margins each with row of 9–15 corneous spines. Propodi each with row of protuberances or spines and tufts of setae on dorsal surface, ventral margins each with row of small corneous spinules. Carpi of 2nd with row of spines on dorsal margin, occasionally reduced or lacking on left; 3rd with dorsodistal spine, less frequently 1 or 2 additional spines in proximal half, occasionally complete row of spines. Meri with setae on dorsal margins, ventral margins each with 2 or 3 small spines in distal half (2nd) or unarmed (3rd) and with tufts of long setae.

Ischia unarmed, but with setae dorsally and ventrally.

Sternite of 3rd pereopods with subovate or subquadrate anterior lobe provided with tuft of setae on anterior margin. Telson with terminal margins armed with few small and few larger spines toward external angles; posterolateral margins each composed of simple, calcified plate.

Colour. "Eyestalks and antennules white with some brownish markings; antennae red with narrow white bands; 2nd and 3rd maxillipeds vivid deep blue; chelipeds pale to dark brown with a red spot on the propodites; walking legs pale to dark brown." (Schembri and McLay, 1983; voucher photograph).

Distribution. Eastern New Zealand from Motuhora Island to Dunedin; 51–553 m.

Affinities. Australeremus cookii bears close superficial similarities to *A. kirkii* and *A. cristatus*, particularly in the colour pattern of the chelae; however it may be distinguished from both of the latter species by the armature of the dorsal surfaces of the chelae. In *A. cookii* these surfaces are armed with flattened tubercles; in *A. kirkii* and *A. cristatus* these surfaces are armed with spines or spinulose tubercles. A second, and undescribed species is also characterized by flattened tubercles on the dorsal surfaces of the chelae. *Australeremus laurentae* is distinguished from *A. cookii* by the reduced armature on the ambulatory legs and the proportions of the dactyls and propodi of these appendages (also see Affinities under *A. laurentae*).

Remarks. Filhol's (1885b) illustration of *A. cookii* (pl. 51 fig. 2) is inaccurate in several significant points.

1. The depression on the right chela is positioned more dorsolaterally than it actually is.

2. The left chela has a triangular appearance with an elevated crest in the midline; the propodal-carpal articulation is generally in horizontal plane. There is actually only a slight elevation to the midline of the chela and the propodal-carpal articulation is approximately 90° in all specimens we have examined.

3. Filhol's specimen (presumably a male) is shown with paired pleopods on the 3rd to 5th abdominal somites. Only unpaired pleopods are present on the left side, as in most adult paguridae.

Thomson (1898) redescribed *E. cookii* from specimens collected at Dunedin and Stewart Island in south-eastern New Zealand. Although in his text he refers to the chelipeds being covered with rounded granulations, his figures are more suggestive of spines (pl. 20 figs 11–13). We have examined Thomson's specimens from Dunedin (AM G2127) and confirmed their identity as *A. cookii*; however, none agrees with his figures. It is, therefore, possible that his specimens from Stewart Island represent another taxon, perhaps *A. cristatus*. We have not been able to confirm the identity of the mutilated specimen from Bounty Bay that he also referred to *A. cookii*.

Thompson (1930) stated that his specimens of *Eupagurus cookii* fell into two distinct groups, those agreeing with Thomson's (1898) description and those that agreed far better with Filhol's (1883, 1885b) description and figure. Thompson's (1930) "differential diagnoses" clearly substantiate his conclusions. Considering the brevity of Filhol's (1883; 1885b) descriptions and the inaccuracies of his figure, it is not surprising that Thompson proposed the group presumably representing Thomson's (1898) species would prove to be distinct. We have not been able to reexamine Thompson's (1930) collection; however, his descriptions suggest that the group he attributed to Thomson's (1898) taxon was in fact *A. cookii*. Given the variability observed in the armature of the ambulatory legs in this species, Thompson's second group, agreeing with Filhol's figure, may also be *A. cookii* or may represent H. Milne Edwards' (1836) *Pagurus cristatus* (= *A. cristatus*), a species occasionally confounded with *A. cookii*.

Batham (1969), Probert et al. (1979), Rainer (1981), Schembri (1982, 1988), Schembri and McLay (1983), Probert and Wilson (1984), and Taylor et al. (1989) presumably all reported on the same species. We have examined a voucher series of Schembri and McLay's (1983) "*A. cooki*" deposited at the Portobello Marine Laboratory and found both *A. cookii* and *A. kirkii* represented; Schembri's (1982) figures of the antennal flagellum agree equally well with both species. Four lots of specimens from the National Museum of New Zealand (Cr4703, 4910) identified as *A. cookii* have proved to be *A. cristatus*. None of the aforementioned authors included either *A. kirkii* or *A. cristatus* in their faunal lists. As all three species apparently show the red spot of colour on the palms of the chelipeds reportedly characteristic of *A cookii*, until each author's material is examined thoroughly, it will not be possible to confirm their reports of *A. cookii*.

Australeremus laurentae sp. nov.

Figures 8A, C, E; 10A–H

Pylopagurus "mauve antenna 1". — Probert et al., 1979: 386.

Pylopagurus sp. nov. — Schembri, 1982: 869, fig. 8.

Pylopagurus n. sp. — Schembri and McLay, 1983: 31, fig. 13. — Probert and Wilson, 1984: 389. — Schembri, 1988: 93. — Taylor et al., 1989: 1062.

Type material. Holotype. New Zealand, RV *Acheron* stn BS 490 approximately 10 miles SW of Waitotara River (39°57′S, 174°34′E), 33–35 m, 2 Mar 1976, NMNZ Cr8241 (male, 3.0 mm).

Paratypes. Whangarei Harbour, North Island, New Zealand, 27 Sep 1972 NMV J21016 (1 male, 3.3 mm). NE side main island, Open Bay Islands, G.D. Fenwick, 7–11 m, 5 Feb 1976, NMNZ Cr4197 (1 female, 3.1 mm). RV *Acheron* stn BS 408 off Kopumiti Pt, Whangaroa Harbour, 10–15m, 22 Feb 1974, NMNZ Cr7399 (1 male, 3.3 mm). Bare Island, Hawkes Bay (39°49′S, 177°02′E), C. Duffy, 15 m, 13 Dec 1990, USNM 244456, NHRM type colln 4282, RMNH D 40431 (7 males, 1 female with rhizocephalan, 3.1–3.9 mm). RV *Acheron* stn BS 490 approximately 10 mi. SW of Waitotara River Mouth (39°57′S, 174°34′E), 33–35 m, 2 Mar 1976, NMNZ Cr7401 (5 males, 2 females, 3.0 mm). RV *Acheron* stn BS 488 approximately 18 miles S of Waitotara River Mouth (40°09.5′S, 174°36′E), 82 m, 2 Mar 1976, NMNZ Cr7400 (1 male, 1 female, 3.4, 3.6 mm). RV *Acheron* stn BS 500, off Port Gore, Marlborough Sounds (40°57.5′S, 174°18′E), 139–144 m, 3 Mar 1976, NMNZ Cr4913 (4 males, 5 females, 2 with rhizocephalans, 1.6–3.8 mm). Tawero Point, Pelorus Sound, K.W. Briden, 11.5–15 m, 6 Dec, 1989, NMNZ Cr34 (1 female with rhizocephalan, 3.6 mm). Off South Trio Island, Admiralty Bay, 5 Apr, 1990, NMNZ Cr52 (1 female, 2.1 mm). Clay Point, P. Fullerton, K. Bayden, 21 m, 8 Apr, 1990, NMNZ Cr51 (1 male 4 females, 1 "intersex", 1.4–3.4 mm). Off Mana I., Wellington, V. Hoggard, 21 m, 27 Apr 1969, NMNZ Cr7398 (2 males, 1 female, 1.8–2.2 mm). USNS *Eltanin* stn 25/370 (43°22′S, 175°20′E), 95 m, 19 Nov 1966, USNM 244455 (1 ovigerous female, 4.0 mm). Hanson Bay, Chatham Islands (44°00′S, 176°18′E), 27 m, 27 Jan 1954, NMNZ Cr4199 (1 ovigerous female, 1.6 mm). USNS *Eltanin* stn 16/1431 (45°37′S, 170°58′E), 51 m, 23 Feb 1965, USNM 244462 (1 male, 3 females, 1.9–3.0 mm).

Description. Shield as long or longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margin sloping; posterior margin truncate. Rostrum triangular, terminating in small spinule. Lateral projections broadly rounded, with submarginal spine. Posterior carapace with tufts of setae adjacent to cervical groove.

Ocular peduncles ¾–⅘ length of shield, corneae slightly dilated. Ocular acicles triangular, terminating subacutely and with strong submarginal spine; separated basally by ¾–slightly more than basal width of 1 acicle.

Antennular peduncles when extended overreaching ocular peduncles by ½–¾ length of ultimate segment. Ultimate segment with 2 or 3 long setae at dorsolateral distal margin. Penultimate segment with few scattered setae. Basal segment with spine on lateral face distally.

Antennal peduncles overreaching corneae by ½–¾ length of ultimate segment. Fifth and fourth segments with scattered setae dorsally and ventrally. Third segment with ventrodistal angle usually unarmed, occasionally with small spinule on ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in acute spine, mesial margin with 2 or 3 accessory spines; dorsomesial distal angle with small spine. First segment occasionally with small spine or spinule on lateral distal margin, ventral margin produced, unarmed or with small spine laterally. Antennal acicle reaching to base of ocular peduncles, terminating in acute spine, ornmaneted with numerous tufts of setae. Flagella with 3 or 4 very long (>5 articles length) every 1 or 2 articles proximally, every 2–4 articles distally.

Chela of right cheliped subrectangular in dorsal view; dactyl ½–⅔ length of palm; cutting edge with row of calcareous teeth in proximal ⅘, corneous teeth distally, terminating in corneous claw and overlapped by fixed finger. Dorsal surface of dactyl with small, usually flattened tubercles, often covering entire surface, dorsomesial margin with row of closely-spaced spines and few tufts of setae; mesial face and ventral surface with few tufts of setae. Palm ⅔–¾ length of carpus; dorsomesial, dorsoproximal and dorsolateral margins each with row of closely-spaced, blunt or acute spines joined to completely circumscribe palm and fixed finger, dorsal surface of palm and fixed finger generally level, covered with flattened tubercles, occasionally those of midline developed into low, tear drop-shaped spines; mesial, lateral and ventral surfaces unarmed, but with few scattered setae; cutting edge of fixed finger with row of calcareous teeth, terminating in corneous claw. Carpus slightly longer than merus; dorsomesial margin with row of acute spines, dorsal surface flattened, with 1 or 2 spines near distal margin and row of spines laterad of midline, dorsolateral margin not distinctly delimited but with transverse ridges and tufts of setae extending onto lateral face dorsally; ventrolateral margin unarmed; mesial face weakly concave, unarmed but with scattered short setae; ventral surface

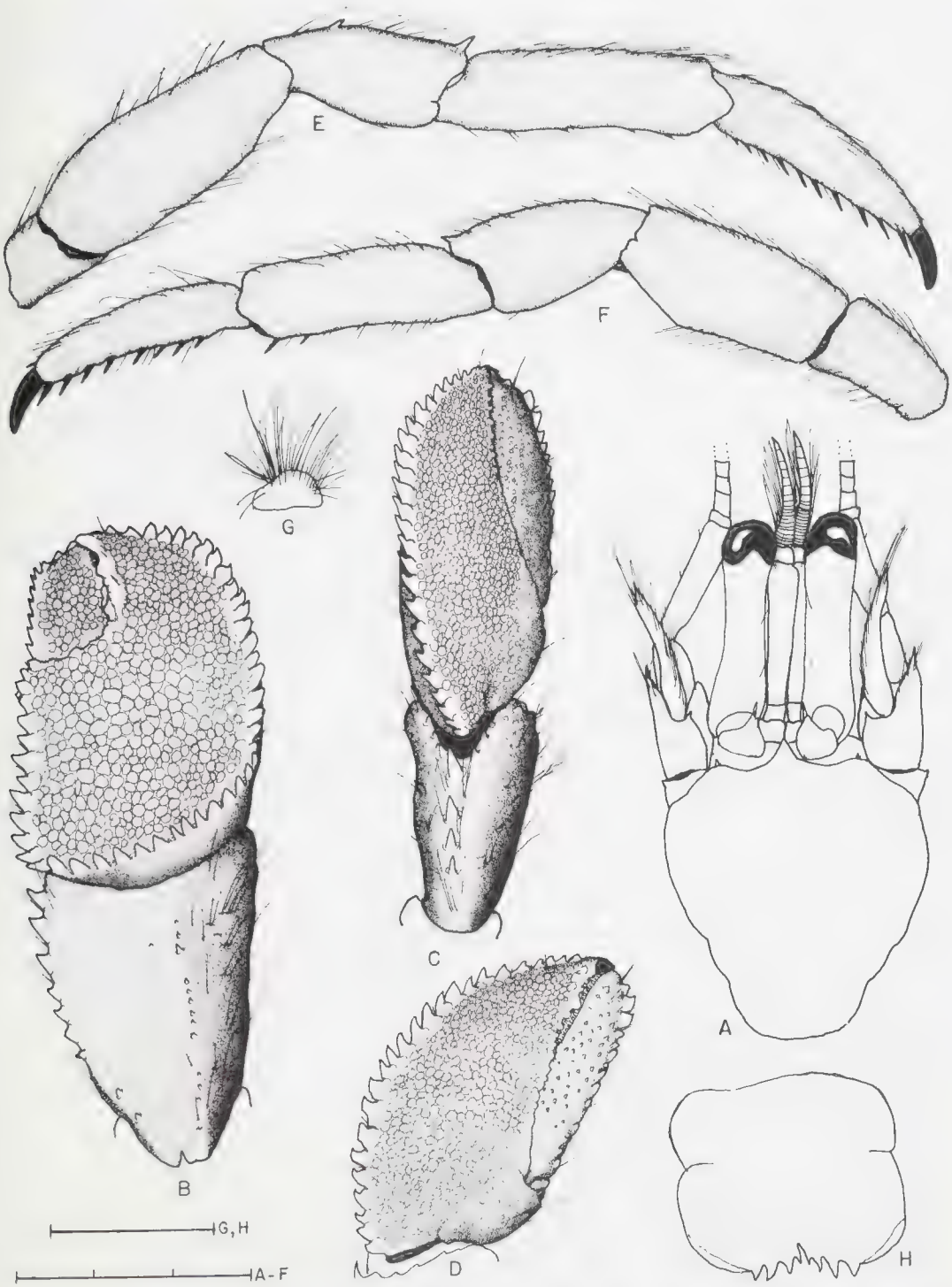


Figure 10. *Australeremus laurentae* sp. nov., male paratype, from Bare Island, Hawkes Bay, New Zealand, USNM 244456. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, chela of left cheliped (dorsomesial view); E, right 2nd pereopod (lateral view); F, left 3rd pereopod (lateral view); G, anterior lobe of sternite of 3rd pereopods; H, telson. Scales = 3 mm (A–F) and 1 mm (G, H).

with scattered, short setae. Merus with 1 acute spine at dorsodistal margin, dorsal surface with transverse rows of tufts of setae; ventromesial margin with 2 or 3 spines or spinulose tubercles in proximal half, ventrolateral margin with short row of acute spines in distal half. Ischium with row of tubercles or spinules on ventromesial margin.

Left cheliped somewhat shorter than right; propodal-carpal angle of articulation 80°–90° from horizontal plane. Dactyl 2½–3 times length of palm; cutting edge with row of corneous teeth, terminating in corneous claw and overlapped by fixed finger; dorsal surface usually with 2 or 3 irregular rows of small granules or spinules, dorsomesial margin with row of small spines and few setae; ventral surface with scattered setae. Palm with dorsolateral margin strongly elevated proximally and armed with row of strong, compressed spines, decreasing in size only slightly on fixed finger, dorsal surface covered with usually low, flattened tubercles laterally but with only scattered small tubercles mesially, dorsomesial margin with 2 or 3 spinulose protuberances; cutting edge of fixed finger with row of small calcareous teeth interspersed with corneous teeth, terminating in corneous claw. Carpus triangular in cross-section; dorsal midline with row of very strong, acute spines and tufts of moderately long setae; mesial and lateral distal margins often spinulose, surfaces with scattered tufts of setae; ventrolateral margin usually unarmed, ventromesial margin with few spinulose tubercles. Merus with transverse ridges and tufts of setae on dorsal margin; ventrolateral margin with row of acute spines distally, ventromesial margin with few spines or spinulose tubercles proximally. Ischium with row of tubercles or spinules on ventromesial margin.

Ambulatory legs generally similar from right to left. Dactyls shorter than propodi; broad proximally, tapering distally; terminating in strong, corneous claws; dorsal margins each with somewhat spinulose protuberances or small spines (2nd) or low protuberances (3rd) and tufts of setae, lateral and mesial faces each with faint longitudinal sulcus, ventral margins each with row of 8–12 corneous spines. Propodi each with row of low protuberances and tufts of setae on dorsal surface, ventral margins each usually with row of widely-spaced corneous spinules. Carpi each with spine at dorsodistal margin, 2nd (at least right) also with 1 spine in proximal half of dorsal margin. Meri unarmed, but with setae on dorsal and ventral margins. Ischia with setae dorsally and ventrally.

Sternite of 3rd pereopods with subsemicircular anterior lobe provided with tuft of setae on anterior margin; sternites of 4th and 5th pereopods frequently with row of thick setae. Uropods most frequently symmetrical. Telson with terminal margins armed with few small to moderately large spines near median cleft; posterolateral margins each composed of simple, calcified plate.

Colour. (Few weeks in preservative): Chelae with dorsal surfaces uniformly orange. Dactyls of ambulatory legs white proximally, medially and distally separated by bands of colour, and with 1 coloured longitudinal striped on lateral and mesial face; propodi and meri each with median band of colour, propodi also with coloured median longitudinal stripe on mesial and lateral face; carpi with 2 or 3 longitudinal stripes of colour on lateral faces.

Etymology. This species is named for Michèle de Saint Laurent who first recognized its distinction from *A. cookii*.

Distribution. Western and eastern North Island to eastern South Island, New Zealand and Chatham Islands; 10–144 m.

Affinities. Australeremus laurentae is most closely allied to *A. cookii*. These species share the distinctive flattened tuberculate armature of the chelae that sets them apart from other species of the genus. Similarly, the dactyls of the ambulatory legs of both species may have spinose dorsal margins. *Australeremus laurentae* is most easily distinguished from *A. cookii* in the following characters. The palm of the right chela lacks the deep rectangular depression on the dorsomesial surface that is usually present in all but the smallest specimens of *A. cookii*. The dactyls of the 2nd and 3rd pereopods of *A. laurentae* are shorter than the propodi; the carpi of the 2nd pereopods (only) have 1 dorsodistal and 1 dorsoproximal spine; the ventral margins of the meri of both 2nd and 3rd pereopods are unarmed. The ventrolateral margin of the carpus of the right cheliped in this species is also unarmed, whereas this margin in *A. cookii* is crenulate, tuberculate or spinulose. It also appears that *A. laurentae* lacks the dark red spot of colour at the articulation of the dactyls and fixed fingers of the chelae that is present in *A. cookii*, *A. cristatus*, and *A. kirkii*.

Remarks. Whereas variation in the armature of the pereopods appears highly variable in *A. cookii*, the flattened tubercles characteristic of the

dorsal surfaces of the palms of the chelae appears constant. However, in *A. laurentae*, the pereopodal armature appears to remain constant, but the tubercles in the midline of the dorsal surface of the palm of the right chela occasionally may be slightly produced to form very low, blunt tear-drop shaped spines.

The specimens of *A. laurentae* collected just north of Bare Island, Hawkes Bay were found on a small reef under a canopy of the brown kelp *Ecklonia radiata* (C. Agardh) J. Agardh. There was a sparse understorey of small algae (greens, browns and reds), the bryozoan *Orthoscuticella* sp. and the massive sponge *Ancorina alata*. The rock surface was heavily encrusted with coralline algae, which was thinly covered with a fine silt. The hermits were very common, occuring individually or in small clusters of up to 4 or 5 animals, either with their encrusted shells exposed on the surface of the rock or tucked away in small fissures and crevices [C. Duffy (collector), pers. comm.].

Australeremus cristatus (H. Milne Edwards)

Figure 11

Pagurus cristatus H. Milne Edwards, 1836: 269. — 1837: 218. — 1848: 60. — Dana, 1853: 441. — Gordan, 1956: 329.

Eupagurus cristatus. — Miers, 1876: 62 (? in part; see remarks). — Hutton, 1882: 264. — Filhol, 1885b: 412. — Thomson, 1898: 184. — Alcock, 1905: 176.

?*Eupagurus cookii*. — Thompson, 1930: 270 (in part), see remarks.

Pylopagurus cristatus. — Forest and de Saint Laurent, 1967: 145. — McLaughlin, 1981a: 3.

?*Lophopagurus cristatus*. — McLaughlin, 1981a: 3 (by implication).

Not *Pagurus cristatus*. — White, 1847: 59 (see remarks).

Holotype. Not seen.

Material examined. RV *Tangaroa*, NZOI stn R 83 (37°45.8′S, 177°00.8′E), 72–84 m, 20 Jan 1979, NMNZ Cr8349 (1 male, 4.6 mm). RV *Tangaroa*, NZOI stn R 86 (37°51.8′S, 176°56.8′E) 34–39 m, 21 Jan 1979 NMNZ Cr8350, (1 female, 4.4 mm). Approximately 3 mi. offshore from Kaikoura, 30–60 m, 24 Jan 1967, NMNZ Cr3965 (8 males, 2 intersex, 9 females, 5.7–8.2 mm). Off Kaikoura 1 mi., I. Mannering, 75 m, 10 Mar 1965, NMNZ Cr4116 (1 male, 9 females, 2 ovigerous females, 3.3–6.9 mm) RV *Acheron* stn BS 557, 5 mi. E of Steep Head, Banks Peninsula (43°45′S, 173°14′E) 66 m, 27 Sep 1976, NMNZ Cr8351 (1 ovigerous female, 6.0 mm). RV *Acheron* stn BS 556, E of Pompeys Pillar (43°52.5′S, 173°06′E), 44 m, 27 Sep 1976, NMNZ Cr4910 (1 male, 2 intersex – 1 with rhizocephalan parasite, 1 ovigerous female, 3.2–6.4 mm).

Redescription. Shield approximately as broad as long; anterior margin between rostrum and lateral projections concave; posterior margin truncate. Rostrum, triangular, acute, with minute terminal spinule. Lateral projections obtusely triangular, terminating in strong, marginal spine. Posterior carapace with tufts of setae adjacent to cervical groove.

Ocular peduncles short, ½–⅔ length of shield; dorsal surface with row of tufts of setae; corneae very slightly inflated. Ocular acicles narrowly triangular, terminating subacutely, and with strong submarginal spine; separated basally by slightly more than basal width of 1 acicle.

Antennular peduncles exceed ocular peduncles by almost entire length of ultimate segment. Ultimate segment with tuft of long setae on dorsolateral distal angle.

Antennal peduncles overreach ocular peduncles by ½–⅔ length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with small spine at ventrodistal angle. Second segment with dorsolateral distal angle produced, terminating in strong spine, mesial margin with series (6–10) of small spines or spinules, lateral margin with few setae; dorsomesial distal angle with acute spine. First segment with small spine at laterodistal margin. Antennal acicle overreaching ocular peduncle by ¼–⅓ own length, terminating in small spine, mesial margin with row of tufts of setae. Antennal flagellum not reaching to tip of right cheliped; articles randomly provided with 1 or 2 short to moderately long (1–3 article length) setae.

Right cheliped with dactyl slightly longer than palm; cutting edge with row of calcareous teeth in proximal ⅔, corneous teeth distally; terminating in small corneous claw; dorsomesial margin with row of closely-spaced small spines, dorsal midline only slightly elevated, dorsal surface covered with small, sometimes spinulose, tubercles, few tufts of setae near cutting edge; ventral surface with scattered tubercles. Palm approximately ⅔ length of carpus; dorsomesial margin with row of strong, acute spines, dorsal surface covered with closely-spaced spines or spinulose tubercles, midline with broad low longitudinal ridge separated from similar mesial ridge by longitudinal depression, 1 or 2 strong spines near dorsomesial margin proximally; dorsal surface of fixed finger similarly armed with closely-spaced small spinulose tubercles, dorsolateral margin with row of very closely-spaced small, acute or blunt spines becoming stronger near proximal margin; lateral face convex,

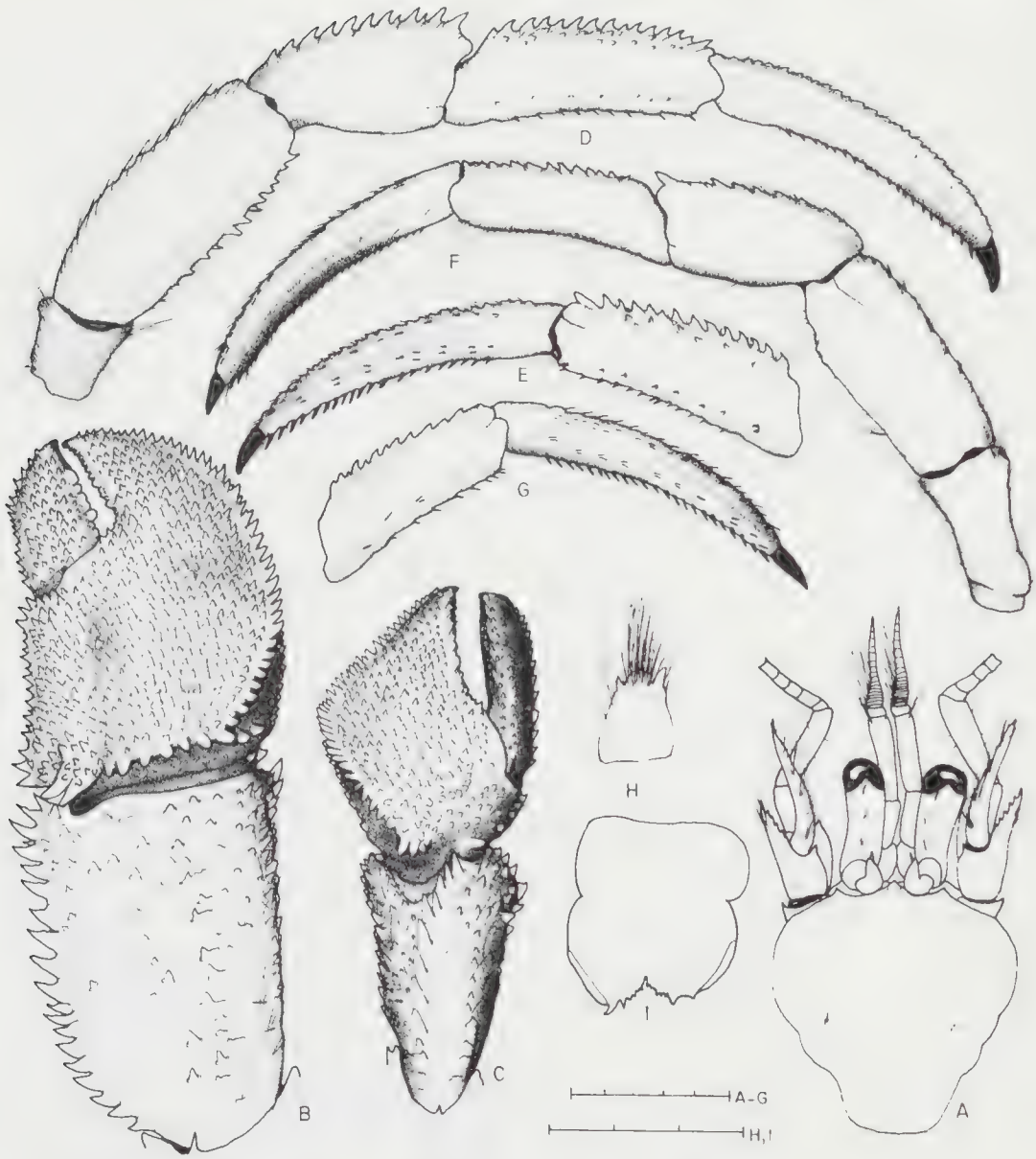


Figure 11. *Australeremus cristatus* (H. Milne Edwards), female from off Kaikoura, New Zealand, NMNZ Cr3965. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, propodus and dactyl of right 2nd pereopod (mesial view); F, left 3rd pereopod (lateral view); G, propodus and dactyl of left 3rd pereopod (mesial view); H, anterior lobe of sternite of 3rd pereopods; I, telson. Scales = 5 mm (A–G) and 3 mm (H, I).

armed with rows of small spinulose tubercles extending onto ventral surface. Carpus approximately equaling length of merus; dorsomesial margin expanded or flared laterally and armed with row of closely-spaced strong spines, dorsal surface with few tubercles distally, row of small spines laterad of midline, dorsolateral margin with single or double row of small spines or spinulose tubercles, extending onto lateral face, ventrolateral margin with row of small spines;

mesial face somewhat concave and with few low spines or spinulose tubercles; ventral surface with few tubercles. Merus with 1 or 2 strong spines at dorsodistal margin, dorsal surface with transverse rows of tufts of long setae; mesial face with few scattered tubercles ventrally, ventromesial margin with row of spines; ventral surface with scattered tubercles, ventrolateral margin with row of acute spines. Ischium with row of spines on ventromesial margin.

Left cheliped not reaching to base of dactyl of right. Dactyl 3 to 4 times length of propodus; dorsal surface strongly sloping ventrally displacing dorsomesial row of spines to ventral marginal position; cutting edge with row of corneous teeth, terminating in corneous claw and slightly overlapped by fixed finger; often with prominent hiatus between dactyl and fixed finger. Palm ¼–⅓ length of carpus; broadly expanded laterally; propodal-carpal angle of articulation approximately 80°from horizontal plane; dorsal surface of palm covered with closely-spaced small spines or spinulose tubercles, dorsolateral margin with row of closely-spaced, acute or blunt spines, 1 strong spine at point of propodal-carpal articulation, dorsomesial margin with few low protuberances or row of small spines; ventral surface with irregular rows of low spinules and scattered tufts of setae in lateral half. Carpus equaling or slightly shorter than merus; subtriangular in cross-section; dorsal midline with oblique row of strong spines and 1 or 2 irregular rows of smaller spines mesially and laterally, distal margin dorsally, laterally and mesially often with continuous row of spines; lateral and mesial faces with scattered spines or spinulose tubercles, ventrolateral and ventromesial margins each with row of spines; ventral surface spinulose. Merus with transverse rows of tufts of setae on dorsal margin, extending onto lateral and mesial faces dorsally; ventrolateral margin with double row of spines proximally, becoming single row distally, ventral surface with scattered small spines or tubercles, ventromesial margin with row of strong spines. Ischium with row of small spines on ventromesial margin.

Second and 3rd pereopods similar from left to right. Dactyls approximately half again length of propodi, terminating in strong corneous claws; in dorsal view, slightly twisted; in lateral view, curved ventrally; dorsal surfaces each armed with row of small calcareous spines accompanied by corneous spinules, at least on 2nd; lateral surfaces each with faint longitudinal sulcus flanked dorsally and ventrally by low protuberances and tufts of setae, ventral margins each with row of 20–24 corneous spines, mesial faces each with dorsal and ventral single or double rows of corneous spines. Propodi approximately equaling length of carpi; dorsal surfaces each with row of strong corneous spines and single or double row of corneous spinules, ventral surfaces each with row of low protuberances and corneous spinules strongest on 2nd. Carpi slightly shorter than meri; dorsal margins each with row of strong spines. Meri with transverse rows of tufts of setae on dorsal surfaces, ventral margins with 1 or 2 rows of spines (2nd) and tufts of setae (3rd). Ischia each with row of spines on ventral margin (2nd) or tufts of setae (3rd).

Sternite of 3rd pereopods with anterior lobe semisubovate, often with 1 or 2 spines near anterior margin and row of long setae. Fourth pereopod without preungual process at base of claw. Telson with posterior lobes slightly asymmetrical; terminal margins oblique, armed with 1–3 strong and several short spines, lateral margins each with undifferentiated plate.

Colour. Unknown; however, in some of the preserved specimens examined, a red-orange patch of colour has been present at the articulation of the dactyls and fixed fingers of both chelae.

Distribution. Eastern New Zealand; 30–84 m.

Affinities. In chela configuration, *A. cristatus* is closely allied to *A. cookii*, and may have been confounded with it by Thompson (1930). The armature of the chelipeds consists of flattened tubercles in *A. cookii* and spinulose tubercles or tuberculate spines in *A. cristatus*. However, the most reliable characters for separating these two species are found in the armature of the ventral margins of the dactyls of the 2nd and 3rd pereopods. In *A. cristatus* the ventral margins of the dactyls of both 2nd and 3rd pereopods are armed with a row of 20–24 corneous spines. In contrast, the ventral margins of the dactyls have only 9–15 corneous spines in *A. cookii*.

Remarks. White (1847) compiled a list of specimens present in the collections of the British Museum. Included among the Paguridae was "*Pagurus cristatus* Edw.". In his catalogue of the stalk- and sessile-eyed New Zealand Crustacea, Miers (1876) presented a species description of *A. cristatus* translated from Milne Edwards' (1836) original description. However, in his remarks, Miers (1876: 62) indicated that he had never seen specimens fitting Milne Edwards' description. Instead, he suggested that *A. crista-*

tus might be identical with *Eupagurus Gayi* Nicolet (= *Pagurus comptus* White), as described by Nicolet (1849) and illustrated in Gay's (1854: pl. i fig. 6) Atlas of Chile, or with *Pagurus novizealandiae* (Dana). In reference to White's (1847) specimens, Miers (1876) stated that White's specimens agreed in all respects with "*Eu. novae-zealandiae*" and placed White's taxon in symonymy with Dana's (1853) species. Alcock (1905) similarly listed White's (1847) *Pagurus cristatus* as a synonym of *Eupagurus novizealandiae*; however, his action was based only on literature citations. Obviously both White (1847) and Miers (1876) incorrectly interpreted *A cristatus*, as Milne Edwards' (1836) species is clearly distinct from either *Pagurus comptus* or *P. novizealandae*.

Thompson (1930) provisionally assigned specimens to *A. cookii* that he thought fell into two distinct groups. One group he believed agreed with Thomson's (1898) description of *A. cookii*, whereas the second group corresponded to Filhol's (1885b) figure of this species. Thomson's (1898) description of the flattened tubercles on the chelae of *A. cookii* is accurate; Filhol's (1885b) figure is not. It is possible that Thompson's (1930) second group may have been *A. cristatus*, but we have not had the opportunity to verify this hypothesis.

As stated in the introduction, McLaughlin's (1981a) assignment of Milne Edwards' (1836) species to *Lophopagurus* was incorrect.

As previously noted, Batham (1969), Probert et al. (1979), Rainer (1981), Schembri and McLay (1983), Probert and Wilson (1984), and Schembri (1988) reported "*A. cooki*" (as *Pagurus*, *Pylopagurus* or *Australeremus*) from Stewart Island and the Otago region. The reference material of "*A. cooki*" deposited at the Portobello Marine Laboratory and referred to by Schembri and McLay (1983) and Schembri (1988) as "*A. cooki*" consists of both *A. cookii* and *A. kirkii* (personal examination). Four lots of specimens from the National Museum of New Zealand (Cr4910, 7403) identified as "*A. cooki*" have been found to actually represent *A. cristatus*. It is clear that considerable confusion has existed in the identification of these species which all apparently show the red spot of colour on the palms of the chelipeds described by Schembri and McLay (1983) as characteristic of *A. cookii*.

Four male specimens of *A. cristatus* we examined from Kaikoura and east of Pompeys Pillar (NMNZ Cr3965, 4910) were found to have paired first pleopods modified as gonopods. Only in one was parasitism by a rhizocephalan apparent. This individual also had one female gonopore. The remaining three males had well developed male gonopores and typical male pleopods 3–5. Although "intersex" individuals (e.g., male and female gonopores present in the same individual) have been reported for a few species of diogenids and pagurids (e.g., Wenner, 1972; McLaughlin, 1974) this is the first time that we have observed female gonopods developed in obviously non-parasitized males. However, as inferred by Hoggarth (1990), the absence of externa does not preclude infection by rhizocephalan parasites.

Australeremus kirkii (Filhol)

Figure 12

Eupagurus Krikii Filhol, 1883: 66.

Eupagurus Kirkii. — Filhol, 1885b: 416, pl. 51, fig. 5.

Eupagurus kirkii. — Thomson, 1898: 175, pl. 20, figs 8–10. — Alcock, 1905: 176.

?*Eupagurus kirkii*. — Thompson, 1930: 269 (see remarks).

Eupagurus kirki. — Borradaile, 1916: 95.

Pagurus kirkii. — Gordan, 1956: 331.

Pylopagurus kirkii. — Forest and de Saint Laurent, 1967: 145.

Pylopagurus kirki. — McLaughlin, 1981a: 3.

?*Lophopagurus kirki*. — McLaughlin, 1981a: 3 (by implication).

Not *Eupagurus kirkii* Miers, 1884: 267, pl. 28, fig. C. (= *Eupagurus hedleyi* Grant and McCulloch, 1906).

Type material. Syntypes: New Zealand, Cook Strait, 1883, Muséum National d'Histoire Naturelle, Paris (male, 4.4 mm; female, 4.3 mm).

Other material. RV *Tangaroa* stn BS 916 (NZOI stn 0.662), off Spirits Bay (34°25.0′S, 172°46.6′E), 29 m, 3 Feb 1981, NMNZ Cr7581 (4 males, 2 females, 2.5–3.6 mm). RV *Tangaroa* stn BS 871 (NZOI stn 0.617), off Rangaunu Bay (34°49.6′S, 175°15.0′E), 23 m, 27 Jan 1981, NMNZ Cr7591 (2 males, 1 female, 2.4–3.1 mm). Bay of Islands, 13 m, 7 Dec 1973, NMNZ Cr7387 (1 male, 2.4 mm). N side of Shakespeare Bay, 10 m, 26 Jan 1978, NMNZ Cr4112 (1 male, 1.7 mm). East Bay, outer Queen Charlotte Sound, C. Duffy, 12 m, 23 Oct 1989 NZCD Cr17, (1 male, 1 female, 3.4, 3.9 mm). Off Papakura Point, East Bay, Queen Charlotte Sound, C. Duffy, 30 m, 15 Jun 1990, USNM 244235, NHRM 16677, RMNH D 40430 (5 males, 1 female, 1 ovigerous female, 2.3–5.7 mm). South Trio Island, Marlborough Sounds, S. Cook and P. Fullerton, 30 m, 5 Apr 1990, NZCD Cr63 (4 males, 2 females, 1 ovigerous female, 2.0–3.5 mm). Continental shelf off Otago Peninsula, P. Schembri, PML (3 males, 3.9–5.2 mm).

Redescription. Shield longer than broad;

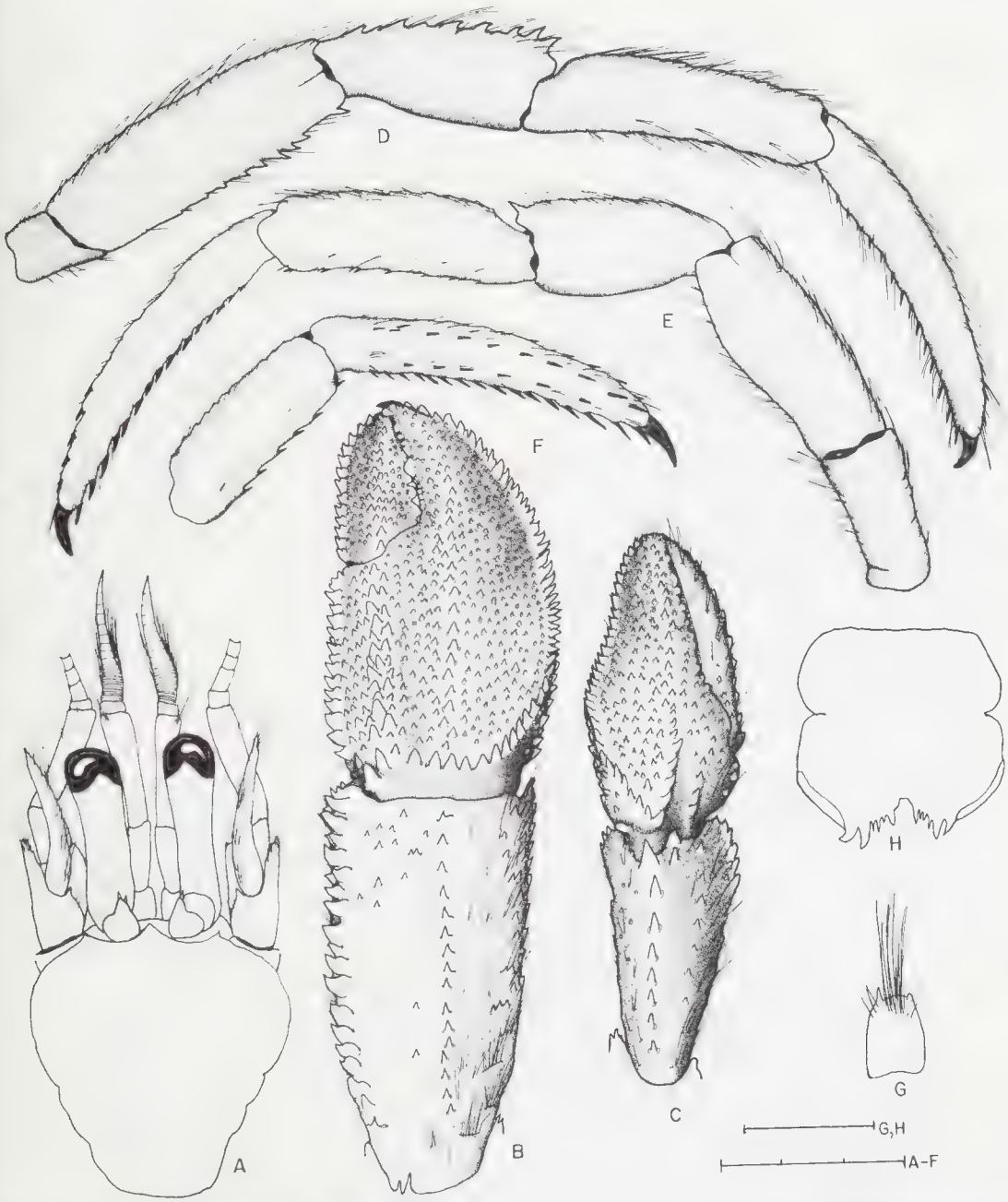


Figure 12. *Australeremus kirkii* (Filhol), male syntype, from Cook Strait, New Zealand, MNHN. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, propodus and dactyl of left 3rd pereopod (mesial view); G, anterior lobe of sternite of 3rd pereopods; H, telson. Scales = 3 mm (A=-F) and 1 mm (G, H).

anterior margin between rostrum and lateral projections concave; posterior margin truncate. Rostrum triangular, acute, terminating in small spine or spinule, occasionally with pair of minute spinules. Lateral projections broadly triangular, with moderately well developed marginal or submarginal spine. Posterior carapace with tufts of setae adjacent to cervical groove.

Ocular peduncles ¾–⅘ shield length, corneae slightly dilated. Ocular acicles acutely triangular, with strong submarginal terminal spine and occasionally accessory marginal spine; separated basally by slightly less than basal width of 1 acicle.

Antennular peduncles overreach ocular peduncles by ½–⅔ length of ultimate segment. Ultimate segment with 3 or 4 long setae at dorsolateral distal angle.

Antennal peduncles overreach ocular peduncles by ⅕–½ length of ultimate segment. Fifth and fourth segments with scattered setae. Third segment with small spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in simple or bifid spine, 1–5 accessory spines on mesial margin, 1 or 2 on lateral margin; dorsomesial distal angle with acute spine. First segment with small spine at laterodistal margin. Antennal acicle sometimes overreaching cornea, terminating in small spine, mesial face with row of tufts of long setae. Antennal flagellum reaching nearly to tip of right cheliped; every second segment with 2 or 3 long (5-6 article length) setae and usually 1 or 2 short setae, at least in proximal ⅔.

Right cheliped with dactyl slightly shorter to slightly longer than palm; terminating in corneous claw and slightly overlapped by fixed finger. Dorsomesial margin of dactyl with row of small spines, dorsal surface slightly elevated in midline and armed with row of small spines, surface mesially and laterally with numerous small spines or spinulose tubercles. Palm ⅔–¾ length of carpus; dorsomesial margin depressed, armed with row of moderately small spines, 1 strong spine at proximal angle dorsolateral and dorsoproximal margins each with row of spines; dorsal surface with numerous spinules or spinulose tubercles on both palm and fixed finger, palm with surface slightly elevated in midline and near dorsomesial margin and armed with irregular single or double row of small spines; lateral face somewhat convex and with few scattered tubercles and tufts of short setae; mesial face and ventral surface similarly armed and ornamented. Carpus slightly longer than merus; dorsomesial margin with row of moderately strong spines and few supplemental spines distally, dorsal surface with row of widely-spaced spines mesiad of midline and row of closely-spaced spines laterad of midline, additional transverse, sometimes spinulose ridges and tufts of setae laterally, dorsolateral margin delimited only faintly by transverse, occasionally spinulose ridges extending onto lateral face; ventrolateral margin with row of small spines or spinulose tubercles, as least in distal half; mesial face somewhat concave, with spinulose tubercles dorsally, distal margin with spinulose tubercles decreasing in size ventrally. Merus with 1 or 2 strong spines at dorsodistal margin, dorsal surface with transverse ridges and tufts of long setae, extending onto lateral and mesial faces; ventromesial margin with row of small spines or spinulose tubercles, ventrolateral margin with row of somewhat stronger spines. Ischium with row of small spines or spinules on ventromesial margin.

Left cheliped with propodal-carpal angle of articulation 50°–60° from horizontal plane. Dactyl 3 to 4 times longer than palm, somewhat triangular in cross-section; terminating in corneous claw; ventrally positioned dorsomesial margin with row of small spines, irregular single or double row of small protuberances or spinules on dorsal midline. Palm approximately ⅓ length of carpus; dorsal surface convex but without median ridge or crest, dorsolateral margin with row of small spines, extending onto fixed finger, dorsal surface laterad of midline with scattered small spinules or spinulose tubercles, midline with small irregular row of spines extending onto fixed finger, dorsomesial surface with few small spines or spinulose tubercles, dorsomesial margin usually with 2 or 3 spinulose tubercles or spines. Carpus approximately equal to length of merus; dorsolateral margin with row of strong acute spines, dorsomesial margin sloping distally and with row of small spines or transverse ridges accompanied by tufts of long setae; mesial face with scattered low tubercles and often 2–4 small spines on distal margin dorsally, ventromesial margin with 1 or 2 rows of tubercles or tuberculate spines in distal half; lateral face with few spinulose tubercles and tufts of setae, laterodistal margin with few small spines in dorsal half; ventral surface often tuberculate and with transverse rows of tufts of setae. Merus with long setae on dorsal surface and dorsodistal margin; lateral and mesial faces each with few transverse rows of long setae, ventrolateral margin with row of small spines, usually strongest in distal half, ventromesial margin with few spines or spinulose tubercles. Ischium with row of small spinules on ventromesial margin.

Second and 3rd pereopods similar from left to right. Dactyls exceeding length of propodi by ⅓–¾ own length; terminating in strong moderately elongate corneous claws; dorsal surfaces each with low protuberances, tufts of stiff setae and often few corneous spinules, lateral faces each

with faint longitudinal sulcus and scattered setae, mesial faces each with dorsal and ventral row of small corneous spinules, ventral margins each with row of 13–16 corneous spines. Propodi slightly longer than carpi; dorsal surfaces all with low protuberances and tufts of setae, ventral surfaces each with row of corneous spinules and tufts of setae. Carpi each with row of spines and tufts of setae on dorsal margin (2nd) or low protuberances, tufts of setae and single dorsodistal spine (3rd), rarely 3rd also with 1 or 2 additional small spines. Meri with tufts of stiff setae on dorsal margins, ventral margins each with tufts of setae and row of spines at least in distal half (2nd) or low protuberances and tufts of setae (3rd). Ischia with tufts of setae on ventral margins.

Sternite of third pereopods with anterior lobe subsemicircular to subsemiovate, anterior margin sometimes with 1 or 2 calcareous spines and with long, stiff setae. Fourth pereopods with small preungual process at base of claw. Telson with terminal margins subcircular to oblique and armed with several calcareous spines, strongest toward outer angles; lateral plates usually with fused denticles.

Colour. In recently (6 weeks) preserved material: Shield mottled red-orange. Ocular peduncles white, acicles with faint red-orange hue. Antennular peduncles opaque with orange at distal margins of ultimate and penultimate segments. Antennal peduncles orange; flagella in proximal half red-orange dorsally and ventrally, white laterally and mesially, with every 4th or 5th article completely white; distal half uniformly red-orange interrupted by white every 4 to 6 articles. Chelae red-orange with tips of dactyls and fixed fingers white or light orange and with red patches on palms dorsally and ventrally at point of articulation with dactyls and ventrally at articulation with carpi, spines red. Carpi uniformly red-orange, darkest at proximal margins. Meri red-orange with band of white at distal margins. Ambulatory legs with uniformly orange dactyls; propodi and carpi light orange or white with longitudinal orange or red-orange stripes; meri orange, but with colour fading unevenly.

Distribution. New Zealand, North Island, Cook Strait, off Otago Peninsula; 12–30 m.

Affinities. Among the species of *Australeremus*, *A. kirkii* bears a superficial resemblance to *A. cookii* and has occasionally been mistakenly identified as that species (personal examination). The presence, in *A. kirkii* of spines or spinulose tubercles on the chelae, rather than the flattened tubercles characteristic of *A. cookii* immediately distinguishes this species. Two other species of *Australeremus*, *A. cristatus* and *A. eltaninae* sp. nov., also have chelae armed with spines or spinulose tubercles; however, in both these species the propodal-carpal articulation is greater (80°–85°) and the dorsal surface of the left palm is not convex.

Remarks. In the original description (Filhol, 1883) *kirkii* was misspelled as "*Krikii*". Filhol (1885b) subsequently corrected this spelling. Thompson's (1930) assignment of specimens to this species appears tentative, as he remarked "A few small specimens, perhaps referable to this species, are present in the collection".

As previously noted, McLaughlin's (1981a) assignment of Filhol's species to *Australeremus* was based only on Filhol's (1883, 1885b) descriptions and illustration and a photograph of one of the syntypes; therefore the assignment was considered questionable until actual specimens could be examined.

No data are available for the specimens of *A. kirkii* in the Portobello Marine Laboratory collection; however they apparently were collected from the continental shelf off the Otago Peninsula (P.K. Probert, pers. comm.).

Australeremus stewarti (Filhol)

Figures 8B, D, F; 13A–H

Eupagurus Stewarti Filhol, 1883: 67. — 1885b: 418, pl. 51 fig. 3.

Eupagurus stewarti. — Thomson, 1898: 180. — Alcock, 1905: 176. — Chilton, 1911: 298 (in part, see remarks). — Thompson, 1930: 269.

Pagurus stewarti. — Gordan, 1956: 335.

Pylopagurus stewarti. — Forest and de Saint Laurent, 1967: 145. — Probert et al., 1979: 381. — McLaughlin, 1981a: 3. — Schembri, 1982: 869. — 1988: 93.–Schembri and McLay, 1983: 30, figs 12a, b, 14. — Probert and Wilson, 1984: 389. — Taylor et al., 1989: 1062.

? Not "a hermit crab". — Morton and Miller, 1968, fig. 215 (2) by implication of Schembri and McLay (1983).

Type material. Holotype not seen.

Other material. New Zealand. Wanganella Bank, Norfolk Ridge, RV *Tangaroa* stn BS 886 (NZOI stn 0.632) (32°35.3′S, 167°41.8′E), 422–437 m, 29 Jan 1981, NMNZ Cr8144 (1 female, 2.0 mm). USNS *Eltanin* stn 23/1709 (43°31′S, 176°10′W), 143–183 m, 24 May 1966, USNM 244445 (4 males, 1 female, 1.5–3.3 mm). Chatham Island Expedition stn 34 (44°4′S,

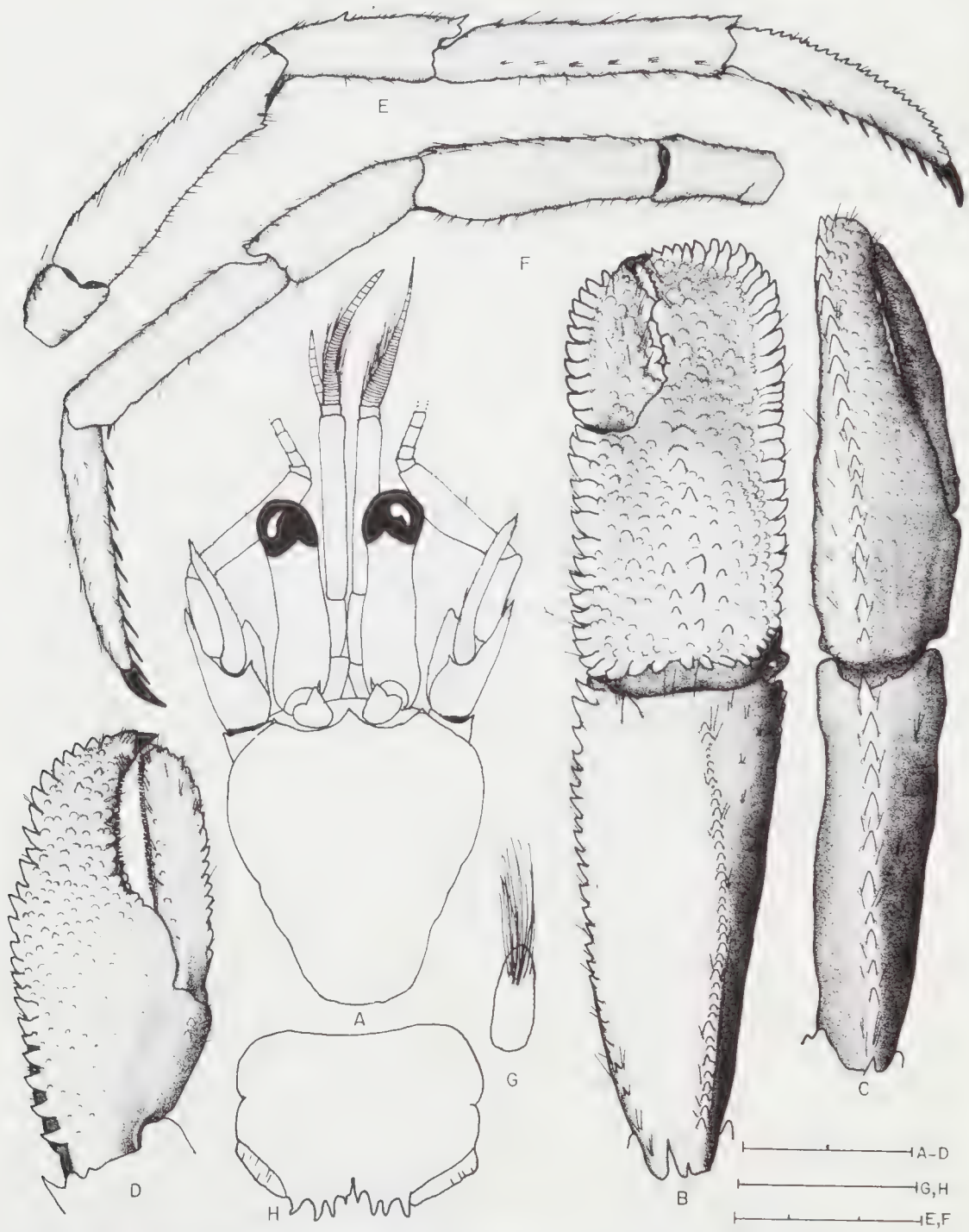


Figure 13. *Australeremus stewarti* (Filhol), male from *Eltanin* stn 23/1709, USNM 244445. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view), C, chela and carpus of left cheliped (dorsal view); D, chela of left cheliped (dorsomesial view); E, right 2nd pereopod (lateral view); F, left 3rd pereopod (lateral view); G, anterior lobe of sternite of 3rd pereopods; H, telson. Scales = 3 mm (E, F), 2 mm (A–D) and 1 mm (G, H).

175°25.5′E), 238 m, 1 Feb 1954, NMNZ Cr3900, 3901, 3902 (1 male, 2 females, 1.3–2.2 mm). NZOI stn B 196 (46°20.6′S, 170°27.6E), 135 m, 18 Oct 1959, NMNZ Cr3905 (1 male, 3.2 mm). *James Cook* stn 100573, mid Foveaux Strait, 28 m, NMNZ Cr3903, 3904 (1 male, 1 female, 3.2, 3.4 mm). USNS *Eltanin* stn 16/1430 (49°19′S, 171°36′E) 165–192 m, 22 Feb 1965, USNM 244444, 244451 (3 males, 2 females, 1 juvenile, 0.4–2.8 mm). USNS *Eltanin* stn 51/590 (52°08.5′S, 169°43.7′E), 91–92 m, 20 Jan 1972, USNM 244453, NHRM 16676, RMNH D 40432 (27 males, 19 females, 4 ovigerous females, 1.0–2.7 mm).

Redescription. Shield is considerably longer than broad; anterior margin between rostrum and lateral projections concave. Rostrum acutely triangular, terminating in small spinule. Lateral projections obtusely triangular, with small submarginal spine.

Ocular peduncles ⅔–¾ length of shield, moderately stout. Ocular acicles triangular, terminating rather bluntly but with strong submarginal spine; separated basally by ⅔–entire basal width of 1 acicle.

Antennular peduncles overreach ocular peduncles by ½–⅔ length of ultimate segment.

Antennal peduncles overreach ocular peduncles by ½–⅔ length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with ventrodistal margin unarmed. Second segment with dorsolateral distal angle produced, terminating in acute spine, mesial margin with 0–2 accessory spinules; dorsomesial distal angle with strong spine. First segment with dorsolateral distal angle sometimes with small spine. Antennal acicle not reaching tip of cornea, terminating in small spine and with tufts of setae on mesial face. Antennal flagellum not overreaching right cheliped, every article, at least proximally, with 2 or 3 long (3–5 article length) setae.

Right cheliped with subrectangular, often elongate carpus and chela. Dactyl ⅓–⅔ length of palm; cutting edge with 2 or 3 strong calcareous teeth in proximal ⅔, short row of corneous teeth distally; terminating in corneous claw; dorsomesial margin with row of strong, somewhat blunted spines, dorsal surface with scattered weak to prominent tubercles. Palm ⅔–slightly less than half length of carpus; dorsomesial, dorsoproximal and dorsolateral margins all with row of strong, somewhat blunted spines entirely circumscribing palm and fixed finger, dorsal surface level or slightly convex and with numerous small to prominent, sometimes spinulose tubercles, occasionally becoming heavily calcified nodules, largest forming irregular row in midline but frequently not extending onto fixed finger; cutting edge of fixed finger with large calcareous teeth proximally and smaller teeth distally; terminating in corneous claw, dorsal surface with numerous small to moderately large tubercles and few scattered setae. Carpus ⅓–½ longer than merus, dorsal width ½ or appreciably less (large specimens) than length; dorsomesial margin with row of spines becoming stronger and more acute distally, 1 strong spine near dorsodistal margin, row of low sometimes spinulose tubercles on dorsolateral margin proximally curving mesially onto dorsal surface in distal half, but frequently also delimited distally by short row of tubercles, dorsal surface with few scattered tufts of setae; lateral and ventral surfaces with transverse rows of tubercles or protuberances and few setae. Merus acutely triangular in cross-section; dorsodistal margin with 1 strong acute spine and often second smaller spine; ventrolateral margin with row of spines in distal third, ventromesial margin with row of spines in proximal ⅔. Ischium with row of blunt spines on ventromesial margin.

Left cheliped with propodal-carpal articulation 85°–90° from horizontal plane. Dactyl 2–3 times length of palm, dorsoventrally flattened; cutting edge with row of corneous teeth, terminating in small corneous claw; dorsal surface unarmed or with row of low tubercles near cutting edge, dorsomesial margin with row of low tubercles or spinules at least distally and few tufts of setae. Palm ⅓–⅙ length of carpus; dorsolateral margin of palm and fixed finger with row of strong spines, dorsal surface generally flattened, armed with numerous weak to prominent tubercles, stronger and more numerous on fixed finger, dorsomesial margin with few setae and occasionally 1 or 2 small tubercles. Carpus acutely triangular in cross-section; dorsal margin with row of sharp spines visually continuous with marginal spines of palm and fixed finger; distal margins laterally and mesially with 1–3 small spines, lateral and mesial faces with scattered setae. Merus as long or slightly longer than carpus; dorsal margin with low protuberances and tufts of setae, dorsodistal margin with strong spine; ventrolateral distal angle sometimes with 1 acute spine, ventromesial margin with row of spines. Ischium with row of spines on ventral margin.

Ambulatory legs dissimilar. Second pereopods with dactyls ⅔–⅗ length of propodi, somewhat laterally flattened, dorsal margins each usually with row of strong spines, occasionally only protuberances; ventral margins each with 8–10 corneous spines and scattered tufts

setae. Propodi exceed carpi by ¼–⅓ own length; sometimes with spine at dorsodistal margin, dorsal surfaces usually with low protuberances or small spines and tufts of setae, ventrodistal margins each with 1 corneous spinule. Carpi ⅔–⅘ length of meri; dorsal margins each with 1 spine at distal margin, usually 1 additional spine in proximal half and row of tufts of setae. Meri elongate; dorsal surfaces with low protuberances and tufts of setae, ventrolateral margins with or without 1 spine distally. Third pereopods differ in having narrower dactyls with unarmed dorsal margins; propodi lack spine at dorsodistal margin or on dorsal surfaces; carpi with only dorsodistal spine; meri lack spine at ventrolateral distal angles. Ischia of both 2nd and 3rd pereopods unarmed, but with tufts of setae.

Sternite of 3rd pereopods with narrowly triangular or rod-like anterior lobe terminating with tuft of setae. Fourth pereopods with short dactyl; small preungual process at base of claw. Fifth abdominal somite usually with numerous stiff setae dorsally. Uropods symmetrical. Telson with terminal margins of posterior lobes straight, slightly oblique, or slightly rounded, armed with 2 to 4 strong spines and occasionally 1 or 2 small spines, lateral plates often weakly calcified.

Colour. "Eyestalks pale orange; antennules uniform pale yellow; antennae reddish with narrow white bands; chelipeds reddish-pink to orange with some darker markings and a purple band at the distal end of the inner surface of the meropodites (this band varies in intensity from very distinct to faded); walking legs orange ground colour with white bands towards the tips." (Schembri and McLay, 1983).

Distribution. Wanganella Bank, North Island, Chatham Islands, southern New Zealand and Tasman Sea to 52°S latitude; 28–457 m.

Affinities. Australeremus stewarti appears most closely allied to *A. eltaninae* sp. nov. Both species have spatulate pereopodal dactyls, the second being dorsally armed with spines or spinulose protuberances. Similarly the chelae are armed with tear-drop shaped spines, although these are usually stronger in the latter species, and the pereopodal carpi have only a single spine at the dorsodistal margin and frequently 1 additional spine in the proximal half of the dorsal surface (2nd). In large specimens (SL >3.0 mm) the length-width ratio of the carpus of the right cheliped immediately distinguishes the two species. The carpus in *A. stewarti* is 2½–3 times longer than wide, whereas this segment is only ⅓–¼ longer than wide in *A. eltaninae*. In smaller specimens of *A. stewarti* this ratio is not as pronounced; however, the carpal length is still at least twice the width. The mesial surface of this segment is rounded or relatively straight in *A. stewarti*; however, because of the flared dorsomesial margin in *A. eltaninae* the mesial face is noticeably concave. If both species are available for comparison, the subrectangular shape of the right chela of *A. stewarti* immediately sets this species apart from *A. eltaninae* with its subtriangular chela.

In general configuration of the chelipeds and frequently in armature of the dactyls of the 2nd pereopods, *A. stewarti* also bears a superficial resemblance to *A. cookii*. However, several characters provide easy separation of the two species. The dorsal surfaces of the chelae, particularly the right, are armed with flattened, closely-spaced tubercles in *A. cookii*; the carpi of the 2nd (at least right) and frequently also the 3rd pereopods are provided with a row of spines. In *A. stewarti* the armature of the dorsal surface of the chelae varies from small spinules to well developed, large tubercles, strongest in the midline on the right chela; the dorsal surfaces of the carpi of the 2nd pereopods are armed only with one spine at the dorsodistal margin and one additional spine in the proximal half. *Australeremus stewarti* is distinct from all other species currently assigned to the genus in having a covering of stiff setae on the dorsal surface of the fifth abdominal somite; however, as these setae may be broken off, it is not considered diagnostic.

Remarks. Filhol (1883) described, but did not illustrate *Eupagurus stewarti* from a single male specimen collected at Stewart Island off the southern coast of New Zealand. In a subsequent publication, Filhol (1885b) repeated his description, which was then accompanied by an illustration. This later publication was cited by both Thomson (1898) and Chilton (1911) as the date of original description. Filhol's figure (1885b, pl. 51 fig. 3) of *A. stewarti* is inaccurate in that the left chela is shown in a horizontally plane position in its relationship to the carpus; the abdomen is depicted with paired abdominal pleopods. Thompson's (1899) diagnosis of this species was simply a translation of Filhol's (1883; 1885b) description. Thomson apparently had not seen the species.

The specimens referred to *A. stewarti* by Thompson (1930) included those reported on earlier by Chilton (1911). Thompson found both

A. stewarti and *A. cookii* represented, but could not determine the range of *A. stewarti* since specimens from the *Nora Niven* stns had been combined. Schembri and McLay (1983) and Schembri (1988) reported *A. stewarti* off the Otago Peninsula, and our present material extends the eastern range of this species to off Chatham Island. However, the specimen from *Nora Niven* stn 79 (Porangahau Bay) (cf. Chilton, 1911) south of Cape Kidnappers, North Island is probably correctly referred to *A. cookii*.

Schembri and McLay (1983) referred to Morton and Miller (1968) in citing the habitat of *A. stewarti* as "bryozoan tubes", thus implying that the authors' caption "a hermit crab, with a polyzoan-formed extension to its gastropod shell" for figure 215 (2) referred to *A stewarti*. Given the broadly rounded dorsolateral margin of the right chela depicted by Morton and Miller, it is more probable that the species illustrated was *A. cookii*, which is also known to inhabit bryozoan tubes.

Australeremus triserratus (Ortmann)

Figure 14, plate 1

Eupagurus triserratus Ortmann, 1892: 308, pl. 12 fig. 15. — Alcock, 1905: 177 (list). — Balss, 1913: 52 (key). — Terao, 1913: 373.

?*Eupagurus tricarinatus*. — Balss, 1913: 58 (? not *Eupagurus tricarinatus* Stimpson, 1858) (see remarks).

? *Eupagurus triserratus*. — Yokoya, 1933: 84. — Kamita, 1958: 67 (see remarks).

Eupagurus triserratus(?). — Shiino, 1936: 184 (see remarks).

Eupagurus (*Eupagurus*) *triserratus*. — Melin, 1939: 29, figs 9, 10.

? *Pagurus tricarinatus*. — Gordan, 1956: 336 (in part) (see remarks). — Miyake, 1982: 197 (list) (see remarks).

?*Pagurus triserratus*. — Gordan, 1956: 336. — Miyake, 1978: 101, fig. 39. — Morgan, 1990: 26 (see remarks).

Pagurus triserratus. — Kim, 1964: 5, pl. 1 fig. 6. — 1970: 8. — 1973: 225, 599, fig. 50, pl. 65 fig. 30.

Pylopagurus serpulophilus Miyake, 1978: 120, pl. 4 fig. 4. — 1982: 120, pl. 40 fig. 5. — McLaughlin, 1981a: 3.

Type material. Lectotype (herein designated): type locality, Sagamibai (Japan), 100 m, 1881, MZUS (male, 3.6 mm).

Paralectotype: MZUS (male, 3.3 mm).

Other material. Dr S. Bock's Japan Expedition: "Sagami Misaki Okinose", 150–300 m, 1914, NHRM 11537, 11290, USNM 244450 (4 males, 7 females, 4 ovigerous females, 1.1–2.7 mm). "Nordostlich von Ototojima", 105 m, 31 Jul 1914, ZMUU (3 males, 1.4–1.6 mm). "Ostlich von Chichijima", 100 m, 1 Aug 1914, NHRM 14899 (3 males, 1 female, 1.1–2.3 mm). "Ostlich von Chichijima", 105 m, 7 Aug 1914, ZMUU (2 males, 0.8, 1.1 mm). "2 Meilen ostlich von Higashijima", 135 m, 7 Aug 1914, ZMUU (3 males, 3 females, 1 ovigerous, 1.2–1.6 mm) [Melin (1939) reported 2 males, 4 females]. "Ost fr channel", 120 m, 1 Aug 1914, ZMUU (1 female, 2.0 mm). SW of Kao-Hsiuhg, Taiwan, South China Sea, 72–91 m, 13 Oct 1972, F.B. Steiner, CAS 046659 (1 female, 1.7 mm).

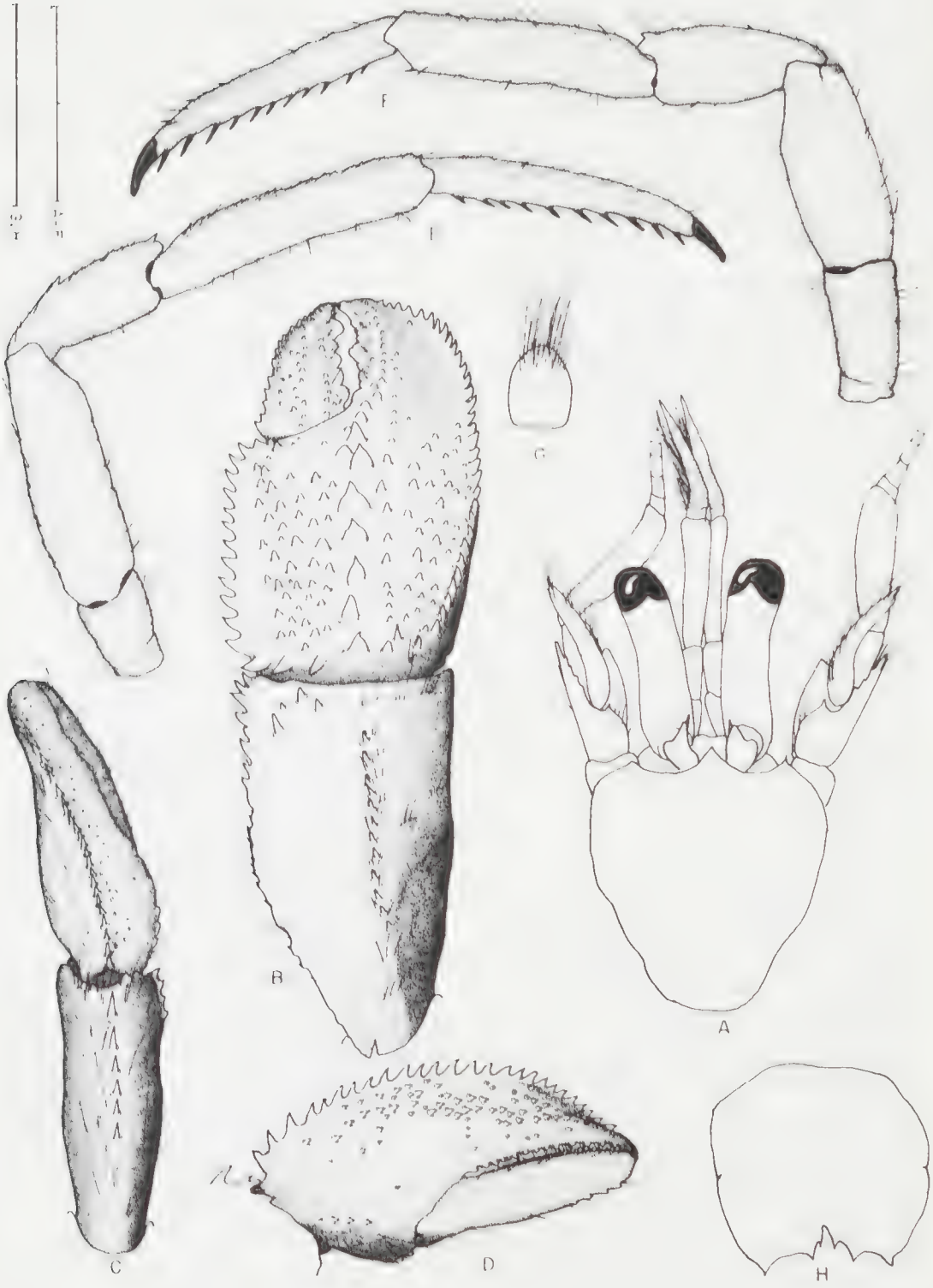
Redescription. Shield slightly to considerably longer than broad; anterior margin between rostrum and lateral projections concave. Rostrum acutely triangular, terminating in small spinule. Lateral projections broadly rounded, with marginal or submarginal spine. Posterior carapace usually with tufts of long setae mesially, adjacent to cervical groove.

Ocular peduncles ⅔–⅘ length of shield, moderately slender. Ocular acicles acutely triangular, terminating subacutely and with strong submarginal spine; separated basally by ¾–entire basal width of 1 acicle. Interocular lobes weakly to moderately well developed.

Antennular peduncles overreach ocular peduncles by ¼–½ length of ultimate segment.

Antennal peduncles overreach ocular peduncles by ⅓–½ length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with ventrodistal margin unarmed. Second segment with dorsolateral distal angle produced, terminating in acute spine, mesial margin with 0 to several accessory spinules; dorsomesial distal angle with strong spine. First segment with acute spine at dorsolateral distal angle or unarmed. Antennal acicle not reaching distal margin of cornea, terminating in small spine and with tufts of setae on mesial face. Antennal flagellum not overreaching right cheliped; every article proximally with 2 or 3 long (4–6 article length) and 1 or 2 short setae, long setae every second article distally.

Right cheliped with dactyl ⅔–approximately equaling length of palm; cutting edge with 3 or 4 strong calcareous teeth in proximal five-sixths, short row of corneous teeth distally; terminating in corneous claw; dorsomesial margin with row of spines, dorsal surface with scattered low or sometimes spinulose tubercles. Palm ⅔–⅘ length of carpus; dorsomesial, dorsoproximal and dorsolateral margins all with row of acute spines entirely circumscribing palm and fixed finger, dorsal surface slightly convex and with numerous weak to prominent and occasionally spinulose tubercles, midline with single or


F
E
G
A
B
C
D
H

occasionally double row of spines decreasing in size on fixed finger and becoming obsolete near tip; cutting edge of fixed finger with large calcareous teeth proximally and smaller teeth distally; terminating in corneous claw, dorsal surface with few spinules or low tubercles and few scattered setae. Carpus ¼–⅓ longer than merus, with mesial face appreciably concave in large specimens (SL >2.0 mm); dorsomesial margin with row of spines becoming stronger and more acute distally, 1–3 spines at or near dorsodistal margin, row of small spines on dorsomesial margin proximally curving mesially onto dorsal surface in distal half, all surfaces with scattered tufts of setae. Merus triangular in cross-section; dorsodistal margin with 1 strong acute spine; ventrolateral margin with row of spines in distal third, ventromesial margin with 3 or 4 blunt to acute spines proximally. Ischium with row of blunt spines on ventromesial margin.

Left cheliped with propodal-carpal articulation 75°–80° from horizontal plane. Dactyl 1½–2 times length of palm, dorsoventrally flattened; cutting edge with row of corneous teeth; terminating in small corneous claw; dorsal surface usually with few minute spinules near cutting edge, dorsomesial margin often with row of low tubercles or spinules and few tufts of setae. Palm half length of carpus; dorsolateral margin of palm and fixed finger with row of strong spines, dorsal surfaces generally flattened, armed with 2 irregular rows of tubercles or spinules, dorsomesial margin with few setae and occasionally 1 or 2 small tubercles. Carpus acutely triangular in cross-section; dorsal margin with row of acute spines, distal margin mesially with 1–3 small spines; frequently 1 or 2 blunt spines on ventromesial margin distally, lateral and mesial faces with scattered setae. Merus as long or slightly longer than carpus; dorsal margin with low protuberances and tufts of setae; ventromesial margin with row of small spines or spinules, ventrolateral margin usually unarmed in small specimens (<2.5 mm), with row of well developed spines in larger specimens. Ischium with few spinules or tubercles on ventral margin.

Ambulatory legs generally similar (2nd right missing in lectotype). Dactyls as long or longer than propodi; dorsal margins each with row of tufts of setae and 3 or 4 corneous spinules in distal half, ventral margins each with 7–11 corneous spines and scattered tufts of setae. Propodi 1½–2 times length of carpi; dorsal and ventral surfaces with low protuberances and tufts of setae, ventrodistal margins unarmed (2nd) or with 1 corneous spinule (3rd). Carpi ⅔–⅘ length of meri; dorsal margins each with 1 spine at distal angle, 2nd often also with 1 additional spine in proximal half. Dorsal and ventral surfaces of meri with low protuberances and tufts of setae. Ischia unarmed, but with tufts of setae.

Sternite of 3rd pereopods with semisubovate anterior lobe terminating with tuft of setae. Fourth pereopods with moderately short dactyls; small preungual process at base of claw. Dorsal surface of 6th abdominal somite frequently with few long setae; uropods symmetrical. Telson with terminal margins of posterior lobes straight or slightly oblique, armed with 2–4 strong spines and occasionally 1 or 2 small spines, lateral plates reduced.

Colour. "(in formalin). Ground colour of body and legs light red-brown. Carapace with one paired dark red-brown spots before and after cervical groove. Antennal flagellum with light and dark red-brown segments alternatively. Chela and wrist dark red-brown; merus light red-brown with three dark coloured cross-bands. Walking legs light red-brown; merus and dactylus each with two dark coloured cross-bands; carpus and propodus each with two dark coloured cross-bands." (Miyake, 1978).

Distribution. Sagami Bay, Sea of Sagami, Tanabe Bay, Amakusa, East China Sea (Miyake); Bonin Islands, South China Sea; 60–400 m.

Affinities. The armature of the chelipeds and pereopodal carpi suggest relationships among *A. triserratus*, *A. stewarti* and *A. eltaninae*; however, the armature of the dactyls of the 2nd pereopods immediately separates the latter two taxa from *A. triserratus*.

Remarks. Two apparently similar Japanese species have been reported and in some

Figure 14. *Australeremus triserratus* (Ortmann), ovigerous female from "Sagami Misaki Okinose", NHRM 11637. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, chela of left cheliped (dorsomesial view); E, right 2nd pereopod (lateral view); F, left 3rd pereopod (lateral view); G, anterior lobe of sternite of 3rd pereopods; H, telson. Scales = 2 mm (A–F) and 1 mm (G, H).

instances probably confounded, i.e., *Pagurus tricarinatus* (Stimpson, 1858) [not *P. tricarinatus* of Norman, 1869 = *P. alatus* Fabricius (Ingle, 1985)] and *Australeremus triserratus* (Ortmann, 1892). Stimpson's (1858) brief description of *P. tricarinatus* (repeated in 1907) seemingly was based on a single specimen, sex not indicated; the species has never been illustrated. Most of Stimpson's materials were lost in the Chicago fire of 1871 (cf. Rathbun, 1883); however, his description is sufficiently diagnostic in certain respects that it is probable that if found again this taxon could be recognized such as his "*Eupagurus acantholepis*" recently was (cf. Gunn and McLaughlin, 1989). It does not appear that *P. tricarinatus* is conspecific with *A. triserratus*.

Ortmann's (1892) description of *Eupagurus triserratus*, based on two males and one additional damaged lot, was brief and was accompanied by a single, rather uninformative illustration. He compared this species only to *E. tricarinatus* and separated the taxa primarily by the absence of a rostrum in the latter. We have now had the opportunity to examine the two male specimens described by Ortmann that remain in the collections of the Musée Zoologique, Strasbourg. Both differ from Stimpson's description of *P. tricarinatus* in several significant characters. *P. tricarinatus* is characterized by the absence of a rostrum, the presence of well developed interocular lobes, subequal chelipeds with the right palm bearing marginal and median denticulate keels or crests and ambulatory dactyls that are much longer than the propodi. Ortmann's syntypes both have a well developed rostrum, no appreciable development of interocular lobes, unequal chelipeds, and pereopodal dactyls that are approximatley equal in length to their respective propodi. We select as the lectotype of *Eupagurus triserratus* the larger of the two specimens (SL = 3.6 mm).

Presumably because of its description from Japanese waters, Balss (1913) included *Eupagurus triserratus* in his species key, although it was not among the species he discussed in his report. He did make note of a single male specimen collected from Sagami Bay that he identified as *E. tricarinatus*, remarking that this taxon was only a variety of the European *E. excavatus* Herbst. The key character by which Balss distinguished *E. tricarinatus* from *E. triserratus* and other species was the absence of a rostrum in the former species. However, he remarked that his specimen differed from Stimpson's (1858) description by the presence of a distinct rostral spine. We suspect that Balss actually had a specimen of *A. triserratus* rather than *P. tricarinatus*.

Terao (1913) listed both Stimpson's (1858) and Ortmann's (1892) species in his catalogue of Japanese hermit crabs, but remarked that he had not examined any material of either taxon.

Yokoya (1933) listed *Eupagurus triserratus* from several Japanese localities. For two of these he reported having female specimens; however, as he gave no diagnostic information it is uncertain as to whether he simply failed to notice paired gonopods in these females or in fact misidentified his taxon. He made no mention of *P. tricarinatus*.

The bopyrid isopod *Pseudione intermedia* Nierstrasz and Brender à Brandis was originally described from an unspecified locality in Japan with no host mentioned (Nierstrasz and Brender à Brandis, 1932). Subsequently Shiino (1936) redescribed it on the basis of material from Yahagi, Masaki, Japan as a parasite of "*Eupagurus triserratus*(?)". One specimen of *A. triserratus* from NHRM 11290 was found infected by a parasite of this species (Dr J.C. Markham, personal communication), thus lending support to Shiino's identification of the host hermit crab.

Two lots of "*Eupagurus* (*Eupagurus*) *triserratus*" from Dr Sixten Bock's Japan Expedition identified by G. Melin are present in the collections of the Naturhistoriska Riksmuseet, Stockholm and four in the collections of the Zoologiska Museet, Uppsala Universitet. Of these, four from the Bonin Islands (NHRM 14899, ZMUU) are cited by Melin (1939) in his redescription of Ortmann's (1892) species. Of the other two, one is also from one of Melin's Bonin Islands localities, the other from Sagami Bay (vicinity of 34°57′N 139°35′E). Although Melin's (1939) redescription is quite detailed, he failed to notice paired first pleopods in his female specimens and consequently retained the species in the nominal subgenus *Eupagurus*. Both of Ortmann's (1892) syntypes are larger than any of Melin's (1939) specimens and demonstrate some variations not seen in the smaller specimens. For example, the merus of the left cheliped is armed on both ventral margins in Ortmann's material, the dorsal surface of the right chela of the larger specimen has an almost double row of strong spines. In contrast, only the ventromesial margin of the merus of the left cheliped carries a row of spines in all of Melin's specimens and the dorsal surface of the right chela has a single median row of large spines. Nonetheless, it is clear that Melin's interpret-

ation of Ortmann's species was correct. The presence of females with paired first pleopods in the Bock Expedition material validates the assignment of this taxon to *Australeremus*.

Kamita (1958) cited *E. triserratus* in his discussion of geographical distributions of pagurids in Korea, but gave no information to indicate that he had actually examined this species, *P. tricarinatus* was not reported.

Gordan (1956) listed several citations under *P. tricarinatus*, only three of which appear to actually refer to Stimpson's (1858) taxon (i.e., Alcock, 1905; Balss, 1913, and Terao, 1913). As previously indicated, we suspect that Balss' (1913) report may actually refer to *A. triserratus*. Gordan's (1956) citations of *A. triserratus*, like those of Alcock (1905) were from literature surveys.

Kim (1964) reported *Pagurus triserratus* from Sogwipo, Cheju Do, Korea, based on two male specimens he had collected the previous year. Although he did not describe his material, his figure (pl. 1 fig. 6) strongly suggests that he did in fact have Ortmann's (1892) species. His subsequent reports (Kim, 1970, 1973) were based on these same two specimens.

In his report on the anomuran fauna of Sagami Bay, Miyake (1978: 101, fig. 39) figured and briefly described *Pagurus triserratus*. No mention is made by Miyake of torsion of the left chela and none is apparent in his illustration. Miyake's material included two males and one female from Japanese waters and one male from the East China Sea; however, gonopods in the female were not denoted. These two characters, if accurately reported would distinguish this taxon from *A. triserratus*. The Kyushu University crustacean collections were recently moved to Kitakyushu Museum of Natural History and have not yet been cataloged (Dr K. Baba, Dr K. Ueda, pers. comms), therefore we were unsuccessful in our attempt to examine the lot containing both male and female specimens (ZIKU 5604) to verify Miyake's description. In his index of species, Miyake (1978: 184) questionably equated *P. triserratus* to *P. tricarinatus*. Subsequently, he (Miyake, 1982) cited the taxon as *P. tricarinatus* (? = *P. triserratus*). However, his (Miyake, 1978) description of *P. triserratus* differs in several significant respects from Stimpson's (1858) description of *P. tricarinatus*. Miyake described his specimens as having a distinct rostrum; no mention is made of well developed inter-ocular lobes, nor are any illustrated. The chelipeds are unequal; the right palm reportedly is provided with dorsomesial and dorsolateral marginal teeth and a median longitudinal row of tubercular teeth. The dactyls of the ambulatory legs are as long as the propodi. In all of these characters, Miyake's taxon agrees with Ortmann's species. Until the absence of female gonopods and the lack torsion of the left chela can be confirmed, we questionably assign Miyake's taxon to *A. triserratus*.

In his 1978 publication, Miyake also described *Pylopagurus serpulophilus* as a new species from Sagami Bay. The major difference between *P. serpulophilus* and *A. triserratus* would appear to be in the armature of the right cheliped. In his description of the right chela, Miyake made no mention of spines on the dorsoproximal margin, nor are any spines apparent in his illustration. However the photograph of *P. serpulophilis* in his subsequent report (Miyake, 1982, pl. 40 fig. 5) does show a row of dorsoproximal spines. We have found only two additional, and minor, differences between our specimens of *A. triserratus* and Miyake's (1978) description and illustration of *P. serpulophilus*. Miyake described the ocular peduncles of his species as short, however, his illustration (pl. 4 fig. 4) shows moderately long ocular peduncles. The smallest of our specimens do have relatively short ocular peduncles, but with increased specimen size, the ocular peduncles of *A. triserratus* are moderately long and slender. Similarly Miyake described the carpi of the pereopods as having only a single spine at the dorsodistal margin. Our one East China Sea specimen and most specimens of *A. triserratus* from Sagami Bay and the Bonin Islands have a second spine or spinule on the dorsal margin of the carpus of each 2nd pereopod; however, this spine is frequently very small and could easily be overlooked. On the basis of present evidence, we believe that *Pylopagurus serpulophilus* is conspecific with *A. triserratus*; the latter name has priority.

In his comparison of *Pagurus triserratus* with his new species *P. boriaustraliensis*, Morgan (1990) stated that the dactyls of the ambulatory legs of the former species were as long or longer than the propodi; the antennal flagella were extremely short. The pereopodal dactyls are approximately equal to the propodi in length in all specimens of *A. triserratus* that we have examined; however the antennal flagella, while not overreaching the right cheliped, cannot be considered extremely short. Since *A. triserratus* has not been reported from north-western Australia, we assume that Morgan's comparison was based only on Ortmann's (1892) description and figure.

Australeremus eltaninae sp. nov.

Figure 15

Type material. Holotype: New Zealand, USNS *Eltanin* stn 231/1716 (39°35′S, 178°46′E), 128–146 m, 28 May 1966, USNM 244463 (male (3.6 mm).

Paratypes. RV *Tangaroa* stn BS 840 (NZOI stn O. 581), Ranfurley Bank (37°34.6′S 178°52.8′E), 35–39 m, 22 Jan 1981, NMNZ Cr8132 (1 male, 3.2 mm). RV *Tangaroa* stn BS 837 (NZOI stn O. 582), Ranfurley Bank (37°35.0′S 178°52.8′E), 31–47 m, 22 Jan 1981, NMNZ Cr8131 (3 males, 1.8–3.4 mm). RV *Tangaroa* stn BS 838 (NZOI stn O. 583), Ranfurley Bank (37°35.4′S 178°52.9′E), 34–54 m, 22 Jan 1981, NMNZ Cr8130 (2 females, 1.9, 2.0 mm). RV *Tangaroa* stns BS 834, 838 (NZOI stn O. 579), Ranfurley Bank (37°36.7′S 178°51.6′E), 56–63 m, 22 Jan 1981, NMNZ Cr8060, 8133 (1 male, 1 female, 1.8, 2.8 mm). RV *Tangaroa* stn BS 840 (NZOI stn O. 585), Ranfurley Bank (37°38.4′S 178°51.7′E), 79–83 m, 22 Jan 1981, NMNZ Cr8148, 8150 (3 males, 1 female, 1.9–2.5 mm).

Description. Shield as long or longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin truncate; dorsal surface with few scattered setae. Rostrum triangular, with small terminal spinule. Lateral projections broadly rounded, with small submarginal spine.

Ocular peduncles ¾–⅘ shield length, corneae slightly dilated; dorsomesial surface with row of short setae. Ocular acicles acutely triangular, with strong submarginal spine; separated basally by slightly less to slightly more than basal width of 1 acicle.

Antennular peduncles exceeding ocular peduncles by ¼–½ length of ultimate segment. Ultimate segment with several setae at dorsolateral distal angle. Penultimate segment with few scattered setae. Basal segment with small spine on lateral face dorsally.

Antennal peduncles overreach ocular peduncles by ¼–⅓ length of ultimate segment. Fifth and fourth segments with scattered setae. Third segment with small spinule at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in acute spine, mesial and lateral margins usually with 1–4 accessory spinules, and tufts of setae; dorsomesial distal angle with acute spine. First segment with small spine at laterodistal margin; ventral margin produced and with 1 small spine laterally. Antennal acicle reaching beyond base of cornea, strongly arcuate, terminating in strong spine; mesial face with row of tufts of short to moderately long setae. Antennal flagellum with 2–4 long and 1 or 2 short setae every article proximally and every second to fourth article distally.

Right cheliped (missing in holotype) with subtriangular chela (dorsal view); dactyl shorter than palm; slightly overlapped by fixed finger, terminating in small corneous claw; cutting edge with row of large calcareous teeth; cutting edge of fixed finger also with row of calcareous teeth. Dorsomesial margin of dactyl with row of strong spines, dorsal surface with 2 rows of prominent, blunt tubercles, mesial and ventral surfaces with scattered setae. Palm ½–⅔ length of carpus; dorsomesial, dorsoproximal and dorsolateral margins with strong acute spines circumscribing palm and extending complete length of fixed finger as broad, blunt spines, dorsal surface with row of strong, tear-drop shaped spines adjacent to dorsomesial margin, separated from similar, but stronger median row by slight longitudinal depression, remaining surface of palm and fixed finger with tear-drop shaped, acute or blunt tuberculate spines, frequently interspersed with mushroom-shaped tubercles; mesial, ventral and lateral surfaces unarmed but with scattered setae. Carpus equaling or slightly exceeding length of merus, dorsoventrally considerably deeper than palm; dorsal width <¾ length; dorsomesial margin flared and armed with row of strong acute spines, dorsal surface with only longitudinal row of small spines or spinulose tubercles laterad of midline and rarely 1 small spine at dorsodistal margin; lateral face with row of transverse ridges and tufts of setae dorsally, ventrolateral margin occasionally crenulate; mesial face noticably concave, unarmed; ventral surface with scattered setae. Merus triangular, dorsal margin with few tufts of setae and strong spine at distal margin; ventromesial margin with 4 or 5 acute or blunt spines, ventrolateral margin with short row of acute spines in distal half; ven-

Figure 15. *Australeremus eltaninae* sp. nov. A, C, E–G holotype, from *Eltanin* stn 23/1716, USNM 244463; B, D, male paratype, from Ranfurley Bank, New Zealand, NMNZ 8132. A, shield and cephalic appendages; B, chela and carpus of right cheliped (dorsal view); C, chela and carpus of left cheliped (dorsal view); D, right 2nd pereopod (lateral view); E, left 3rd pereopod (lateral view); F, anterior lobe of sternite of 3rd pereopods; G, telson. Scales = 3 mm (A–E) and 1 mm (F, G).


F
D
E
F-G
A-E
A
C
B
G

tral surface occasionally with 1 or 2 spines distally and with scattered tufts of setae. Ischium with row of small spines on ventromesial margin.

Left cheliped with propodal-carpal articulation 60°–80° from horizontal plane. Dactyl 2½–3½ times longer than palm, somewhat flattened; terminating in strong corneous claw and slightly overlapped by fixed finger; cutting edge with row of corneous teeth; dorsomesial margin with protuberances or small blunt spines, spinules or tubercles proximally, becoming spine-like distally, dorsal surface with few protuberances and short setae. Palm ⅕–¼ length of carpus; dorsolateral margin with row of strong spines, dorsal surface covered with moderate to strong, often tear-drop-shaped spines, sometimes interspersed with mushroom-shaped tubercles, spines smallest and more tuberculate in mesial half, dorsomesial margin with 2 low protuberances and few tufts of setae; lateral and ventral surfaces with low protuberances and scattered tufts of setae. Carpus approximately equaling merus in length; strongly triangular in cross-section; dorsal surface with row of strong acute spines; mesial face with few transverse ridges and tufts of setae, mesiodistal margin with 3 small spines in distal half, ventromesial margin with low protuberances and few long setae; lateral face often with scattered spinules or protuberances and tufts of setae, distal margin with few spinules in dorsal half. Merus with few long setae on dorsal surface; ventral surface appreciably deeper in proximal half, ventrolateral margin with row of acute spines in distal third, ventromesial margin with row of spines, sometimes only in proximal half. Ischium with row of small spines on ventromesial margin.

Ambulatory legs generally similar (2nd right missing in holotype). Dactyls slightly shorter or approximately as long as propodi; somewhat blade-shaped, terminating in strong corneous claws; dorsal margins with low protuberances occasionally developed into spinose processes, row of long corneous spines and tufts of long, stiff setae; lateral and mesial faces with tufts of setae, ventral margins each with row of 7–11 corneous spines. Propodi ¼–½ longer than carpi; with low protuberances and tufts of long setae on dorsal surfaces, ventral surfaces each with tufts of long setae and 2–4 corneous spines in distal half. Carpi of 2nd pereopods with low protuberances and tufts of setae on dorsal surface, frequently also 1 spine or spiniform process in proximal half and 1 or 2 spines at distal margin; dorsal surface of carpi of 3rd occasionally also with spine in proximal half but only single spine at dorsodistal margin. Meri with tufts of setae on dorsal and ventral surfaces. Ischia with tufts of setae dorsally and ventrally.

Sternite of 3rd pereopods with anterior lobe small, semiovate to subsemicircular, and with very long setae on anterior margin. Fourth pereopod with small preungual process at base of claw. Uropods generally symmetrical. Telson with terminal margins rounded, few spines medianly, plate-like laterally and extending onto lateral margins.

Colour. Unknown.

Distribution. New Zealand, known only from the type locality and the Ranfurly Bank; 31–146 m.

Etymology. This species is named for the research vessel USNS *Eltanin.*

Affinities. Australeremus eltaninae is most closely related to *A. stewarti* and *A. triserratus.* The stronger and more prominent spines of the chelae and the blade-shaped pereopodal dactyls immediately distinguish *A. eltaninae* from *A. triserratus.* As previously discussed, *A. eltaninae* is best distinguished from *A. stewarti* by the shape of the chela of the right cheliped and length/width ratio of the carpus of this appendage. However, the row of spines on the ventrolateral margin of the merus of the left cheliped also quickly distinguishes *A. eltaninae* from the latter species where only a single spine is occasionally present. The two species differ also in the configuration of the ventral surfaces of the carpus and merus. The entire carpus and the proximal portion of the merus of the right cheliped are appreciably deeper in *A. eltaninae.*

Remarks. Despite the absence of the right cheliped and second right pereopod, the distinctness of this species was recognized when the parasitized male holotype was initially observed. Subsequently we were able to examine a series of specimens, including females, collected from Ranfurly Bank which enabled us to confirmed the placement of this species in *Australeremus* and present a complete description.

Acknowledgements

The authors wish particularly to acknowledge the prior work on New Zealand hermit crabs by Jacques Forest and Michèle de Saint Laurent, and the information and comparative materials

they graciously provided for this study. We are indebted to Drs Gordon Hendler, Jon Norenburg and Rafael Lemaitre, former or present benthic supervisors at the Smithsonian Oceanographic Sorting Center, for making the US Antarctic collections available. We also acknowledge with thanks the assistance provided by J. Haig, Allan Hancock Foundation, University of Southern California; P.B. Berents, Australian Museum; R. Ingle and P. Clarke, The Natural History Museum; R. Van Syoc, California Academy of Sciences; I. Mannering, Canterbury Museum; K. Ueda, Kitakyushu Museum of Natural History; K. Baba, Kumamoto University; E. Lang, Musée Zoologique, Strasbourg; J. Forest, Muséum National d'Histoire Naturelle, Paris; L.B. Holthuis and C.H. Fransen, Nationaal Natuurhistorisch Museum, Leiden; R.B. Manning, National Museum of Natural History, Smithsonian Institution; W.R. Webber, J.C. Yaldwyn and G.R.F. Hicks, National Museum of New Zealand; G.C.B. Poore, Museum of Victoria; L. Sandberg, Naturhistoriska Rijsmuseet, Stockholm; C. Duffy, New Zealand Department of Conservation; P.K. Probert, Portobello Marine Laboratory; R.L.C. Pilgrim and C. McLay, University of Canterbury; and L. Wallin, Zoologiske Museet, Uppsala Universitet for providing information and/or in making material available for our examination. Information on and the identification of the bopyrid isopod was provided by J.C. Markham. The photographs of *A. triserratus* are the work of E.J. McGeorge. The overall quality of the manuscript has been improved by the careful editing of R. Lemaitre, W.R. Webber and an anonymous reviewer. The initial phase of this study was supported by National Science Foundation grant DEB 76-02552; its completion has been made possible by a Cooperative Systematics Research Program Grant from the Smithsonian Institution and Division of Polar Programs, National Science Foundation. This is a scientfic contribution from the Shannon Point Marine Center, Western Washington University.

References

Alcock, A., 1905. *Catalogue of the Indian decapod Crustacea in the collections of the Indian Museum. Part 2. Anomura. Fasc. I. Paguridea.* pp. 197. Indian Museum: Calcutta.

Anonymous, 1985. *International code of zoological nomenclature adopted by the XX General Assembly of the International Union of Biological Sciences:* 1–338. International Trust for Zoological Nomenclature: London.

Balss, H., 1913. Ostasiatische Decapoden I. Die Galatheiden und Paguriden. In: Beiträge zur Naturgeschichte Ostasiens. *Abhandlungen der mathematisch-Physikalischen Klasse der Königlich Bayerischen Akademie der Wissenschaftern, II. Supplement* 9: 1–85.

Batham, E.J., 1969. Benthic ecology of Glory Cove, Stewart Island. *Transactions of the Royal Society of New Zealand, Biological Sciences* 11 (5): 73–81.

Bell, T., 1844–1853. *A history of the British stalk-eyed Crustacea.* John van Voorst: London. 386 pp. (Issued in parts: pp. 1–48, 1844; pp. 49–96, 1844; pp. 97–144, 1845; pp. 145–192, 1846; pp. 193–240, 1847; pp. 241–288, 1848; pp. 289–336, 1851; pp. 337–386, 1852; pp. ix–lxii, lxii–lxv, 1853.)

Borradaile, L.A., 1916. Crustacea. Part I. Decapoda. *British Antarctic ("Terra Nova") Expedition, 1910. Natural History Report. Zoology* 3 (2): 75–110.

Chilton, C., 1911. Scientific results of the New Zealand Government trawling expedition, 1907. Crustacea. *Records of the Canterbury Museum* 1: 285–312.

Dakin, W.J., Bennett, I. and Pope, E., 1948. A study of certain aspects of the ecology of the intertidal zone of the New South Wales coast. *Australian Journal of Scientific Research* (B) 1: 176–230.

Dakin, W.J., Bennett, I. and Pope, E., 1953. *Australian seashores. A guide for the beachlover, the naturalist, the shore fisherman, and the student.* pp. 372. Angus and Robertson: Sydney.

Dakin, W.J., Bennett, I. and Pope, E., 1960. *Australian seashores. A guide for the beachlover, the naturalist, the shore fisherman, and the student.* (Revised edition) pp. 372. Angus and Robertson: Sydney.

Dana, J.D., 1853. Crustacea. *United States Exploring Expedition during the Years 1838, 1839, 1840, 1841, 1842. Under the command of Charles Wilkes, U.S.N.* 13 (1): vii + 685 pp. C. Sherman: Philadelphia. [Reprinted 1972 Antiquariaat Junk: Lochem].

Filhol, H., 1883. Note sur quelques espèces nouvelles d'*Eupagurus* recueillis en Nouvelle-Zélande. *Bulletin de la Société Philomatique de Paris* (7) 8 (2): 66–68.

Filhol, H., 1885a. Considerations relatives à la fauna des crustacés de la Nouvelle-Zélande. *Bibliothèque de l'École des Hautes Études, Section des Sciences Naturelles* 30 (2): 1–60.

Filhol, H., 1885b. *Recueil de Mémoires, Rapports et Documents relatifs à l'Observation du Passage de Vénus sur le Soleil du 9 Décembre 1874. Mission de l'Île Campbell. Zoologie,* 3 (2) 1: 349–510. Institut de France, Académie des Sciences: Paris.

Forest, J., 1961. Note sur *Pagurus thompsoni* (Filhol) = *P. lacertosus* Henderson). In: R.B. Pike, A new bopyrid parasite collected by the Chatham Islands 1954 Expedition. *New Zealand Department of*

Scientific and Industrial Research, Bulletin 139 (Biological results of the Chatham Islands 1954 Expedition, part 5): 223.

Forest, J. and Saint Laurent, M. de, 1968. Campagne de la "Calypso" au large des côtes Atlantiques de l'Amérique du Sud (1961–1962). 6. Crustacés Décapodes: Pagurides. *Annales de l'Institut Océanographique de Monaco* n. s. 45 (2): 47–172.

Gordan, J., 1956. A bibliography of pagurid crabs, exclusive of Alcock, 1905. *Bulletin of the American Museum of Natural History* 108: 253–352.

Grant, F., 1902. In: O.A. Sayce, 1902. Dredging on Port Phillip. *The Victorian Naturalist* 18: 154–155.

Grant, F.E. and McCulloch, A.R., 1906. On a collection of Crustacea from the Port Curtis District, Queensland. *Proceedings of the Linnean Society of New South Wales* 1906: 1–53.

Griffin, D.J.G., 1967. Hermit crabs. *Australian Natural History* 15 (10): 305–309.

Gunn, S.W. and McLaughlin, P.A., 1989. The rediscovery of *Pagurus acantholepis* (Stimpson) (Decapoda: Anomura: Paguridae). *Memoirs of the Museum of Victoria* 49 (1): 67–71.

Hale, H.M., 1927. *The Crustaceans of South Australia.* Part I. pp. 210. Government Printer: Adelaide.

Hale, H.M., 1941. Decapod Crustacea. *Reports of the British, Australian and New Zealand Research Expedition 1929–1931 Series B (Zoology and Botany)* 4 (9): 257–286.

Healy, A. and Yaldwyn, J., 1970. *Australian Crustaceans in Colour.* pp. 112, Reed: Sydney.

Hemming, F. (Ed.), 1957. Opinion 472. Addition to the official list of generic names in zoology of the generic name *Pagurus* Fabricius, 1775, with *Cancer bernhardus* Linnaeus, 1758, as type species (Class Crustacea, Order Decapoda). *Opinions and Declarations of the International Commission for Zoological Nomenclature* 16: 213–276.

Hemming, F., 1958. *Official index of rejected and invalid generic names in zoology* 1. pp. xii, 132. International Trust for Zoological Nomenclature: London.

Henderson, J.R. 1888. The voyage of H.M.S. Challenger. Report on the Anomura collected by H.M.S. Challenger during the years 1873–76. *Reports on the Scientific results of the Voyage of H.M.S. Challenger during the years 1873–76. Zoology* 27: 1–221.

Hoggarth, D.D., 1990. The effects of parasitism by the rhizocephalan, *Briarosaccus callosus* Boschma on the lithodid crab, *Paralomis granulosa* (Jacquinot) in the Falkland Islands. *Crustaceana* 59: 156–170.

Hutton, F.W., 1882. The stalk-eyed Crustacea of New Zealand. *New Zealand Journal of Science* 1: 263–264.

Ingle, R., 1985. Northeastern Atlantic and Mediterranean hermit crabs (Crustacea: Anomura: Paguroidea: Paguridae). I. The genus *Pagurus* Fabricius, 1775. *Journal of Natural History*, 19: 745–769.

Kamita, T., 1958. Studies on the decapod crustaceans of Corea, Part II. Hermit-crabs (5). *Scientific Reports (Natural Science) of the Shimane University* 8: 59–75. (In Japanese).

Kim, H.S., 1964. A study on the geographical distribution of anomuran decapods of Korea with considerations of the oceanographic conditions. *Sung Kyun Kwan University Journal* 8 (*Supplement*): 1–15. (In Korean).

Kim, H.S., 1970. A checklist of the Anomura and Brachyura (Crustacea, Decapoda) of Korea. *Seoul National University Journal Biology and Agriculture Series* (B) 21: 1–34.

Kim, H.S., 1973. *Illustrated Encyclopedia of Fauna and Flora of Korea, 14. Anomura-Brachyura.* pp. 694. Samhwa Publishing Co.: Seoul. (In Korean).

Leviton, A.E., Gibbs, R.H. Jr., Heal E., and Dawson, C.E., 1985. Standards in herpetology and Ichthyology: Part I. Standard symbolic codes for Institutional Resource collections in herpetology and ichthyology. *Copeia* 1985: 802–832.

Liszka, D. and Underwood, A.J., 1990. An experimental design to determine preferences for gastropod shells by a hermit-crab. *Journal of Experimental Marine Biology and Ecology* 137: 47–62.

Manning, R.B. and Holthuis, L.B., 1981. West African brachyuran crabs (Crustacea: Decapoda). *Smithsonian Contributions to Zoology* 306: 1–379.

McCulloch, A.R., 1913. Studies in Australian Crustacea. No. 3. *Records of the Australian Museum* 9: 321–353.

McLaughlin, P.A., 1974. The hermit crabs (Crustacea Decapoda, Paguridea) of northwestern North America. *Zoologische Verhandelingen* 130: 1–396.

McLaughlin, P.A., 1981a. Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species: Part I. Ten new genera of the Paguridae and a redescription of *Tomopagurus* A. Milne Edwards and Bouvier. *Bulletin of Marine Science* 31: 1–30.

McLaughlin, P.A., 1981b. Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species: Part II. *Rhodochirus* McLaughlin and *Phimochirus* McLaughlin. *Bulletin of Marine Science* 31: 329–365.

McLaughlin, P.A., 1982. Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species: Part III. *Agaricochirus* McLaughlin, *Enallopagurus* McLaughlin, and *Enallopaguropsis* McLaughlin. *Bulletin of Marine Science* 32: 823–855.

McLaughlin, P.A. and Haig, J., 1984. A review of *Pagurixus* (Decapoda, Anomura, Paguridae) and descriptions of new species. *Crustaceana* 47 (2): 121–148.

McLaughlin, P.A. and Haig, J., 1989. On the status of *Pylopaguropsis zebra* (Henderson), *P. magnimanus* (Henderson), and *Galapagurus teevanus* Boone, with descriptions of seven new species of

Pylopaguropsis (Crustacea: Anomura: Paguridae). *Micronesica* 22 (2): 123–171.

Melin, G., 1939. Paguriden und Galatheiden von Prof. Dr. Sixten Bocks Expedition nach den Bonin-Inseln, 1914. *Kongliga Svenska Vetenskapsakademiens Hanglingar* (3) 18 (2): 1–119.

Miers, E.J., 1876. *Catalogue of the stalk- and sessile-eyed Crustacea of New Zealand*. pp. 136. Colonial Museum and Geological Survey Department: London.

Miers, E.J., 1884. Crustacea. *Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of H.M.S. "Alert" 1881–2*: 178–322, 513–575.

Milne Edwards, A., 1880. Reports on the results of dredging under the supervision of Alexander Agassiz in the Gulf of Mexico, and in the Caribbean Sea, 1877, '78, '79 by the U.S. Coast Survey Steamer "Blake", Lieut.-Commander C.D. Sigsbee, U.S.N., and Commander J.R. Bartlett, U.S.N. commanding. VIII. Études préliminaires sur les Crustacés. *Bulletin of the Museum of Comparative Zoology* 8: 1–68.

Milne Edwards, A. and Bouvier, E.L., 1891. Observations générales sur les paguriens recueillis dans la mer des Antilles et le Golfe du Mexique, par le *Blake* et le *Hassler*, sous la direction de M. Alexandre Agassiz. *Bulletin de la Société Philomatique de Paris* (8) 3: 102–110.

Milne Edwards, A. and Bouvier, E.L., 1893. Reports on the results of dredging, under the supervision of Alexander Agassiz, in the Gulf of Mexico (1877–78), in the Caribbean Sea (1878–79), and along the Atlantic coast of the United States (188), by the U.S. Coast Survey steamer "Blake", Lieut.-Commander S.D. Sigsbee, U.S.N., and Commander J.R. Bartlett, U.S.N. commanding. XXXIII. Description des Crustacés de la famille des paguriens recueillis pendant l'expédition. *Memoirs of the Museum of Comparative Zoology* 14: 1–172.

Milne Edwards, H., 1836. Observations zoologiques sur les Pagures et description d'un nouveau genre de la tribu des Paguriens. *Annales des Sciences Naturelle, Zoologie* (2) 6: 257–288.

Milne Edwards, H., 1837. *Histoire naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux*. 2: 1–532; atlas, pp. 1–32, pls. 1–42. Paris.

Milne Edwards, H., 1848. Note sur quelques nouvelles espèces du genre Pagure. *Annales des Sciences Naturelles, Zoologie* (3) 10: 59–64.

Miyake, S., 1978. *The Crustacean Anomura of Sagami Bay*. pp. 200 (English), pp. 161 (Japanese). Hoikusha Publishing Co.: Tokyo.

Miyake, S., 1982. *Japanese Crustacean Decapods and Stomatopods in Color*. I. Macrura, Anomura and Stomatopoda. pp. 261. Hoikusha Publishing Co.: Osaka.

Morgan, G.J., 1990. A collection of Thalassinidea, Anomura and Brachyura (Crustacea: Decapoda) from the Kimberley region of northwestern Australia. *Zoologische Verhandelingen* 265: 1–90.

Morton, J. and Miller, M., 1968. *The New Zealand Sea Shore*. pp. 638. Collins: London and Auckland.

Nicolet, H. 1849. Crustaceos. In: C. Gay, *Historia fisica y politica de Chile* vol. 3 (Zoologia): pp. 1–547. Paris.

Nicolet, H. 1854. Crustaceos. In: G. Gay, *Historia fisica y politica de Chile* Atlas vol. 2: 134 pls. Paris and Santiago.

Nierstrasz, H.F. and Brender à Brandis, G.A., 1932. Alte und neue Epicaridea. *Zoologischer Anzeiger* 101: 90–100.

Ortmann, A., 1892. Die Decapoden-Krebse des Strassburger Museum. IV. Die Abtheilungen Galatheidea und Paguridea. *Zoologisher Jahrbucher Systematik* 6: 241–326.

Pike, R.B., 1961. A new bopyrid parasite collected by the Chatham Islands 1954 expedition. In: *New Zealand Department of Scientific and Industrial Research, Bulletin* 139 (Biological results of the Chatham Islands 1954 Expedition, part 5): 221–223.

Pope, E.C., 1947. The endless house-hunt. *Australian Museum Magazine* 9 (4): 129–132.

Probert, P.K., Batham E.J. and Wilson, J.B., 1979. Epibenthic macrofauna off southeastern New Zealand and midshelf bryozoan dominance. *New Zealand Journal of Marine and Freshwater Research* 13 (3): 379–392.

Probert, P.K. and Wilson, J.B., 1984. Continental shelf benthos of Otago Peninsula, New Zealand. *Estuarine, Coastal and Shelf Science* 19: 373–391.

Rainer, S.F., 1981. Soft-bottom benthic communities in Otago Harbour and Blueskin Bay, New Zealand. *New Zealand Oceanographic Institute Memoir* 80: 1–28.

Rathbun, R., 1883. Descriptive catalogue of the collection illustrating the scientific investigations of the sea and fresh waters. Great International Fisheries Exhibition, London, 1883. *Bulletin of the United States National Museum* 27: 513–621.

Sayce, D.A., 1902. Dredging on Port Phillip. *Victorian Naturalist* 18: 149–155.

Schembri, P.J., 1982. Feeding behaviour of fifteen species of hermit crabs (Crustacea: Decapoda: Anomura) from the Otago region, southeastern New Zealand. *Journal of Natural History*, 16: 859–878.

Schembri, P.K., 1988. Bathymetric distribution of hermit crabs (Crustacea: Decapoda: Anomura) from the Otago region, southeastern New Zealand. *Journal of the Royal Society of New Zealand* 18 (1): 91–102.

Schembri, P.J. and McLay, C.L., 1983. An annotated key to the hermit crabs (Crustacea: Decapoda: Anomura) of the Otago region (southeastern New Zealand). *New Zealand Journal of Marine and Freshwater Research* 17: 27–35.

Shiino, S.M., 1936. Bopyrids from Misaki. *Records of Oceanographic Works in Japan* 8: 177–190.

Stimpson, W., 1858. Crustacea. Prodromus descriptionis animalium evertebratorum, quae in expe-

ditione ad oceanum Pacificum septentrionalem, a Republica Rederata missa, Cadwaldaro Ringgold et Johanne Rodgers ducibus, observavit et descripsit. VII. – [Preprint (December 1858) from] *Proceedings of the Academy of Natural Sciences of Philadelphia* 1858: 225–252.

Stimpson, W., 1907. Report on the Crustacea (Brachyura and Anomura) collected by the Pacific Exploring Expedition, 1853–1856. *Smithsonian Miscellaneous Collections* 49 (1717): 1–240.

Taylor, P.D., Schembri P.J., and Cook, P.L., 1989. Symbiotic associations between hermit crabs and bryozoans from the Otago region, southeastern New Zealand. *Journal of Natural History*, 23: 1059–1085.

Terao, A., 1913. A catalogue of hermit-crabs found in Japan (Paguridae excluding Lithodidae), with descriptions of four new species. *Annotationes Zoologicae Japonenses* 8 (2): 355–391.

Thomson, G.M., 1898. A revision of the Crustacea Anomura of New Zealand. *Transactions and Proceedings of the New Zealand Institute* 31: 167–197.

Thompson, E.F., 1930. Contributions for a revision of the New Zealand Crustacea of the family Paguridae. *Records of the Canterbury Museum* 3 (4): 263–273.

Wenner, A.M., 1972. Sex ratio as a function of size in marine Crustacea. *The American Naturalist* 106: 321–350.

White, A., 1847. *List of the Specimens of Crustacea in the Collection of the British Museum.* pp. vii + 143. British Museum: London.

Whitelegge, T., 1889. List of the marine and freshwater invertebrate fauna of Port Jackson and the neighbourhood. *Journal and Proceedings of the Royal Society of New South Wales* 23 (2): 163–323.

Whitelegge, T., 1900. Scientific results of the trawling expedition of HMCS "Thetis" off the coast of New South Wales, in February and March, 1898. *Memoirs of the Australian Museum* 4: 135–199.

Yaldwyn, J.C., 1975. Checklist of decapod and stomatopod Crustacea from Auckland and Campbell Islands, New Zealand Subantarctic. In: Yaldwyn, J.C. (Ed.) Preliminary Results of the Auckland Islands Expedition 1972–1973. *Department of Lands and Survey, Wellington (Reserve Series)* 1975/3 (10.8): 360–363.

Yokoya, Y., 1933. On the distribution of decapod Crustacea inhabiting the continental shelf around Japan, chiefly based upon the materials collected by S.S. "Soyo Maru" during the years 1923–1930. *Journal of the College of Agriculture, Tokyo Imperial University* 12 (1): 1–236.

Zarenkov, N.A., 1967. Crustacean Decapoda collected by the Soviet Antarctic Expeditions in the Antarctic and Antiboreal regions. *Biological Reports of the Soviet Antarctic Expedition (1955–1958)* 4: 153–201. [Translation by Israel Program for Scientific Translations, 1968].

Plate 1

Australeremus triserratus (Ortmann), lectotype, MZUS. Upper left. Whole specimen, dorsal view, 5.4 times. Lower left. Original label accompanying type lot, original size. Upper right. Enlarged dorsal view of right chela, 6.1 times. Lower right. Enlarged dorsomesial view of left chela, 7.2 times.


MUSÉE ZOOLOGIQUE
de
L'UNIVERSITÉ
et de la
VILLE
STRASBOURG
Type.
Eupagurus
trisserratus
Oztmann
Sagamibai
(Japan)
1oom. 1881.

Memoirs of the Museum of Victoria 53(1): 101–114 (1992)

REVISION OF THE GENUS *CHEILOXENA* BALY (COLEOPTERA: CHRYSOMELIDAE: EUMOLPINAE)

By C. A. M. Reid

Division of Botany and Zoology, Australian National University, GPO Box 4, Canberra, ACT 2601, Australia

Abstract

Reid, C.A.M., 1992. Revision of the genus *Cheiloxena* Baly (Coleoptera: Chrysomelidae: Eumolpinae). *Memoirs of the Museum of Victoria* 53: 101–114.

The unusual eumolpine genus *Cheiloxena* Baly is diagnosed, its three known species are revised and two new species, *C. blackburni* and *C. tuberosa*, are described. Lectotypes are designated for *C. insignis* Blackburn and *C. westwoodii* Baly. A phylogeny of the species is proposed. *Cheiloxena* species are confined to upland areas of mainland south-eastern Australia.

Introduction

The genus *Cheiloxena* Baly was erected for an unusual species of chrysomelid beetle, doubtfully placed in the Sagrinae (Baly, 1860). Two further species were described by Blackburn without comment on the position of the genus (Blackburn, 1893, 1896). The placement in Sagrinae was followed by various authors until the sagrine genera were revised (Crowson, 1946). Crowson placed *Cheiloxena* in the Eumolpinae, noting correspondence between the wing venation of *Cheiloxena* and the African genus *Euryope* Dalman. These ideas were adopted by Jolivet (1950) who also suggested a relationship between *Cheiloxena* and the eumolpine genus *Bechyneia* Jolivet. Selman (1963) illustrated the venter of the prothorax of *Cheiloxena* and showed that it is similar to the eumolpine genus *Spilopyra* Baly. The wing venation (Crowson, 1946; Jolivet, 1950) is of the complete, plesiomorphic chrysomelid type, although a vague subcubital fleck is indicated. Currently *Cheiloxena* is found in section Euryopites of Colasposomini (Seeno and Wilcox, 1982). There can be no doubt that *Cheiloxena* belongs to the Eumolpinae as far as this group is understood and my studies indicate that it is a member of the Spilopyrini. A discussion of the relationship of *Cheiloxena* to other Eumolpinae will be given elsewhere.

Here, the genus and its species are redescribed and a phylogeny proposed. All species are relatively rare and their life-histories are completely unknown.

Material is lodged at the following institutions: Australian Museum, Sydney (AM); Australian National Insect Collection, Canberra (ANIC); Natural History Museum, London (BMNH); Museum of Victoria, Melbourne (NMV); South Australian Museum, Adelaide (SAM).

Cheiloxena Baly

Cheiloxena Baly, 1860: 255. — Chapuis, 1874: 34. — Jacoby 1903: 4. — Crowson, 1946: 76 (Type species, *Cheiloxena westwoodii* Baly, 1860, by monotypy and original designation).

Chiloxena. — Gemminger and von Harold, 1874: 3233. — Clavareau, 1913: 5. — Jolivet, 1950: 1. — Jolivet, 1957: 99 (misspelling).

Cheiloscena. — Selman, 1963: 158 (misspelling).

Chiloscena. — Selman, 1963: 159 (misspelling).

Diagnosis. Eumolpinae of large size, with coarse sculpture, and narrow pronotum. Length 7–15.5 mm; entire body surface non-metallic, densely microsculptured and clothed with scale-like setae; small eyes, interocular space at least 3 times eye length; last 4 segments of antennae shorter than segment 7, cylindrical or ovoid and densely microsculpured and pubescent; elytra tuberculate; elytral punctures with pair of tubercles on internal margins; tibial spurs at apex of all tibiae; tarsal segments 1–3 dorsally hollowed and segment 3 weakly bilobed; claws bifid. Male with last segment of maxillary palp expanded at apex; Female ovipositor non-telescopic, with well-defined dorsal and ventral sclerites and vaginal glands.

Distribution and biology. The species are confined to the south-eastern corner of mainland Australia from Brisbane, Queensland to Melbourne, Victoria on or east of the Dividing Range.

Specimens have been collected from the foliage of *Eucalyptus*, *Astrotriche*, *Argyrodendron*

and *Nothofagus* but have only been recorded feeding on the first. The species appear to favour forested upland country. The immature stages are unknown.

Remarks. Superficially, species of the genus strongly resemble lamiine Cerambycidae and specimens may be found under undetermined Cerambycidae in collections.

Key to species of *Cheiloxena*

1. Pronotum with lateral teeth, disc simple (Figs 24–27) 2
— Pronotum without lateral teeth, disc with pair of strongly raised elongate ridges (Figs 28–31) 4
2. Elytra with strongly raised tubercles, without erect setae; antennal segments elongate 3
— Elytra depressed, without strong tubercles, with evenly distributed erect setae; distal antennal segments moniliform (Fig. 7) ..... *C. insignis* Blackburn
3. Elytra with 4 massive acutely raised tubercles, *c.* half height of elytron at humerus (Fig. 12); pronotum widest across mid and/or anterior lateral tubercles (Fig. 29) ..... *C. tuberosa* sp. nov.
— Elytral tubercles small and not prominent, less than one-third height of elytron at humerus (Figs 13, 14); pronotum widest across mid and/or posterior lateral tubercles ..... *C. westwoodii* Baly
4. Frons depressed between antennae; pronotal ridge evenly tapering posteriorly (Figs 26, 27); apex of aedeagal median lobe abruptly contracted to mucronate tip (Fig. 33) ..... *C. frenchae* Blackburn
— Frons convex between antennae; pronotal ridge abruptly terminating posteriorly (Figs 24, 25); aedeagal median lobe gradually contracted to mucronate tip (Fig. 32) ..... *C. blackburni* sp. nov.

Cheiloxena blackburni sp. nov.

Figures 2, 5, 9, 17, 24, 25, 32, 38

Types. Holotype: ♂ / Blackheath 6.12.1946 C. Oke N.S.W. / (NMV). Paratypes (9): 1♂ / Balook, V.C. Oke / (NMV); 1♂3♀♀, / Blue Mts N.S.Wales / F.W. Ferguson collection /, one with additional label / Cheiloxena westwoodi Baly /, and one with / Cheiloxena sp. W.K. Hughes det. / (ANIC); 1♀ / Blue Mts H.W. Cox / John Captor / Cheiloxena ?frenchi Blkb. / (ANIC); 1♂ / Blue Mts / (SAM); 1♀ / Blue Mts / Cheiloxena 18051 N.S.Wales / (SAM); 1, sex unknown, / Blue M'tains 1-04 / Cheiloxena westwoodi ? var. / (SAM).

Diagnosis. Apical antennal segments elongate and parallel-sided, frons convex between bases of antennae, pronotum without lateral tubercles and with dorsal keels which abruptly terminate posteriorly, elytra with recumbent setae and with small tubercles (less than quarter height of elytron at humerus) near suture.

Description. Entirely black with reddish-brown palpi, and slightly reddish tarsi, apices of tibiae and apical antennal segments; sparsely clothed with broad, rounded recumbent yellowish scales which are clumped on elytra and make them faintly flecked; scutellum scaled; elytra without erect setae; body elongate and cylindrical but broader than *C. frenchae*, ratio of length of elytra and pronotum to width of elytra across humeri < 2.2:1; head vertically declined, hooded by pronotum; length 10.5–11.5 mm (♂) and 12.5–15 mm (♀).

Head (Fig. 2): surface densely punctured, interspaces less than third puncture diameter, shining; frons slightly convex between antennae; anterior margin of frontoclypeus straight, without lateral teeth; antenna (Fig. 5) elongate, length of segment 8 approximately twice width, length of segment 7 approximately 2.5 times width; last segment of ♂ maxillary palp (Fig. 17) slightly expanded at apex.

Pronotum (Figs 24, 25): cordate, broadest at middle, almost parallel in front, sides evenly contracted or slightly sinuate behind; anterior angles produced but without lateral tubercles; upper surface uneven and with pair of subparallel keels on either side of disc from anterior border to midpoint, these ridges abruptly terminating posteriorly; weakly microreticulate; punctures large and shallow with interspaces less than half diameter.

Elytron (Fig. 9): slightly uneven, with scattered small irregular tubercles in 4 rows from base to apex, larger tubercle in the basal half of sutural row, and 2 larger tubercles in middle of apical half, largest tubercles less than quarter

height of elytron at humerus; upper surface of elytra extremely dull and densely microreticulate except for shining apices of tubercles; elytral punctures large, deep, interspaces equal to diameter. Scutellum shining. Metasternum densely and evenly punctured, interspaces less than third of puncture diameters. Legs: ♂ tarsal segments without expanded bases.

Male genitalia (Fig. 32): apex of aedeagal median lobe gradually contracted to blunt mucronate tip; tegmen shallowly keeled.

Female genitalia: spermatheca (Fig. 38) with uncoiled duct and basally swollen, apically pointed, receptaculum; median ventral sclerite moderately elongate.

Distribution and biology. The species is restricted to the Blue Mountains west of Sydney, New South Wales, and Balook, Victoria. It has not been collected since 1946.

The food plant is unknown. Adults were collected in December and January.

Remarks. The species is similar to *C. frenchae*, but with broader antennae (segment 7 *c.*2.5 times longer than wide), convex frons between antennal bases, divergent and abruptly terminated prothoracic keels, small elytral tubercles (3 close to suture larger), and median lobe of aedeagus evenly contracted to mucronate apex.

Cheiloxena frenchae Blackburn

Figures 6, 10, 18, 26, 27, 33, 39, 44

Cheiloxena frenchae Blackburn, 1893: 138.

Chiloxena frenchi. — Clavareau, 1913: 5 (misspelling).

Type. Holotype (by monotypy) ♀: / Latrobe R. Dist. Vict. / Type / Cheiloxena frenchae Blackb. VICTORIA / Nat. Mus. Victoria C. French's coll. 5.11.08 / Nat. Mus. Victoria / Type T-9752 Cheiloxena frenchi [sic] Blkb. / (NMV)

Other material. NSW: 1♂, 5k SW Monga, on *Euc. rubida* C. Reid (ANIC).

Diagnosis. Apical antennal segments elongate and parallel-sided, frons concave between bases of antennae, pronotum without lateral tubercles and with dorsal keels which evenly taper posteriorly, elytra with recumbent setae and with small to medium tubercles (at most third height of elytron at humerus) near suture.

Description. Entirely black with reddish-brown palpi, ♀ with reddish legs; densely (♀) or sparsely (♂) clothed with broad, rounded recumbent offwhite scales which give flecked appearance to elytra; scutellum scaled; elytra without erect setae; body elongate and cylindrical, narrower than *C. blackburni*, ratio of length of elytra and pronotum to width of elytra across humeri > 2.2:1; head vertically declined, hooded by pronotum; length 11 mm (♂) to 15.5 mm (♀).

Head: surface densely punctured, interspaces less than half puncture diameter, shining; frons slightly depressed between antennae; anterior margin of frontoclypeus straight, without lateral teeth; antenna (Fig. 6) elongate, length of segment 8 approximately twice width, length of segment 7 approximately 3 times width; last segment of ♂ maxillary palp (Fig. 18) slightly expanded at apex.

Pronotum (Figs 26, 27): cordate, broadest at middle, almost parallel in front, sides slightly contracted and sinuate behind; anterior angles produced but without lateral tubercles; upper surface uneven and with pair of subparallel keels on either side of disc from anterior border to midpoint, these ridges smoothly attenuating posteriorly; strongly microreticulate; punctures large and shallow with interspaces less than half diameter.

Elytron (Fig. 10): uneven, with scattered small irregular tubercles plus 7 or 8 conical large tubercles in an irregular row near elytral suture; largest tubercles being a pair at apex of elytral disc, closely spaced and densely scaled (), or more distant and less clothed (♂), these tubercles *c.*1/3 height of elyton at humerus; upper surface of elytra extremely dull and densely microreticulate except for shining apices of tubercles; elytral punctures large, deep, interspaces equal to diameter. Scutellum shining. Metasternum irregularly punctured with smooth microreticulate strips between (♀), or densely punctured with a mixture of large and small punctures (♂). Legs: ♂ tarsal segments without expanded bases.

Male genitalia (Fig. 33): apex of aedeagal median lobe abruptly contracted to blunt mucronate tip; tegmen shallowly keeled.

Female genitalia: spermathecal duct (Fig. 39) simple, receptaculum pointed at apex; median ventral sclerite (Fig. 44) very long and narrow.

Distribution and biology. The species is known only from the Latrobe River district, Victoria, and Monga, New South Wales.

The male was collected in November on *Eucalyptus rubida.*

Remarks. This species is similar to *C. blackburni* but has narrower antennae (segment 7 *c.*3 times longer than wide), slightly depressed frons between antennal bases, closer and more evenly tapered prothoracic keels, more prominent ely-

tral tubercles (7–8 larger near suture) and abruptly attenuated aedeagal median lobe.

The specific association of the male described here with the unique female of *C. frenchae* is based on the similarities given above, although the metasternal punctures and dorsal setal distributions are different. Until further material is available, the male from Monga is considered conspecific with *C. frenchae*.

Cheiloxena insignis Blackburn

Figures 7, 11, 15, 16, 19, 28, 34, 40

Cheiloxena insignis Blackburn, 1896: 39. — Jacoby, 1903: 4, plate 1 Fig. 7.

Chiloxena insignis. — Clavareau, 1913: 6.

Types. Lectotype (this designation): ♂ carded and labelled / T.H. Vic / Type / Blackburn coll. 1910.236 / Cheiloxena insignis, Blackb. / (BMNH).

Paralectotypes (3): ♀ / H. Vict / Austral. / Type Blackburn / Jacoby coll. 1909-289 / Cheiloxena insignis Blackb. / (BMNH); 2♂♂ (separate pins) / He.V. / Cheiloxena insignis Blackb. Co-type/ (SAM).

Other material (29): Vic.: Belgrave, Bullarto, Emerald, Fern Tree Gully, Healesville, Launching Place, Macedon, Monbulk, Mount Macedon.

NSW: Mittagong.

Diagnosis. Apical antennal segments moniliform, frons concave between antennal bases, pronotum with lateral tubercles and without dorsal keels, elytra with recumbent and erect setae and with small tubercles (less than fifth height of elytron at humerus) near suture.

Description. Entirely reddish-brown with black tubercles to entirely black with apex of elytra and palpi reddish-brown; generally sparsely clothed with narrow, pointed, adpressed white scales, which form 2 conspicuous patches on each elytron and smaller scattered pale flecks in fresh specimens; scutellum without white scales; elytra with scattered erect setae, arising from tubercles; body form relatively depressed, and head relatively prognathous, not hooded by pronotum; length 7–10 mm.

Head: surface densely punctured, shining; anterior margin of frontoclypeus triangularly excavate in middle and laterally toothed between base of antenna and mandible; frons concave between antennal bases; antenna (Fig. 7) short, last 4 segments moniliform; last segment of ♂ maxillary palp (Fig. 19) very broad.

Pronotum (Fig. 28): strongly contracted to base from middle, sides with 3 irregular teeth in anterior half; upper surface uneven but not tuberculate, reticulately microsculptured but shining; punctures large and shallow, interspaces equal to half– total diameter.

Elytron (Fig. 11): uneven and covered in small irregular tubercles, largest tubercles less than fifth height of elyton at humerus; very densely microsculptured and dull except tips of tubercles shining; elytral punctures large, deep, scattered between tubercles. Scutellum shining. Metasternum closely but very shallowly punctured. Legs: ♂ with all tarsal segments (Fig. 16) expanded at base, ♀ simple.

Male genitalia (Fig. 34): apex of aedeagal median lobe abruptly contracted to acute mucronate tip; tegmen shallowly keeled.

Female genitalia: spermathecal duct (Fig. 40) simple, apex of receptaculum rounded; median ventral sclerite very short, vaginal palp apparently 3-segmented due to median constriction.

Distribution and biology. This species seems to be moderately common and widespread on the coastal slopes of the Dividing Range in central southern Victoria, and has also been collected at Mittagong in New South Wales.

This species has been recorded on eucalypts (Blackburn, 1896). Adults have been collected in April, July, October and November.

Cheiloxena tuberosa sp. nov.

Figures 1, 12, 20, 29, 35, 41

Types. Holotype ♂ / Lamington NP Qld Nov. 1983 M. Lowman / no. 15 / Cheiloxena sp. det. T. Weir 1983 / (ANIC).

Paratypes (5): 1♂ / Dorrigo NSW W. Heron / (ANIC); 2♂ / Dorrigo N.S.Wales W. Heron / (SAM); 1♂ / Mt. Glorious St. For. QLD Nov-Dec 1985 [sic] Y. Basset coll. ex. *Argyrodendron actinophyllum* r/f / ANIC Coleoptera voucher no. 87-0134 / Co/ANT/10 / *Argyrodendron actinophyllum* Edlin subtropical rainforest 19-26.ii.1987 Mt Glorious State Forest Qld Y. Basset 92 / (ANIC); 1♀ / Mt. Warning NSW 11.xii.1977 G. & T. Williams, in rainforest / (AM).

Diagnosis. Apical antennal segments elongate and parallel-sided, frons concave between antennal bases, pronotum with lateral tubercles and without dorsal keels, elytra with recumbent setae and with large tubercles (*c.* half height of elytron at humerus) near suture.

Description. (Fig. 1) Entirely matt black with labrum reddish-brown, or appendages slightly reddish; wholly clothed with slightly variegated pattern of white and yellowish-brown broad, pointed, adpressed scales; white scales widespread but forming small spot on apex of outer elytral margin, yellowish scales tending to be

restricted to dense areas along anterior pronotal border, scutellum and elytral tubercles; pronotal disc very sparsely scaled; elytral tubercle scales twice length of other scales; elytra without erect setae; body form sub-cylindrical, and head hypognathous, hooded by pronotum; length 9–11 mm.

Head: upper vertex densely punctured, less dense between eyes, dull; anterior margin of frontoclypeus triangularly excavate in middle, not laterally toothed between base of antenna and mandible; frons concave between antennal bases; ♂ antenna (Fig. 4) long, last 4 segments very elongate, ♀ antenna (Fig. 1) shorter and with segments 1–7 much narrower; last segment of ♂ maxillary palp (Fig. 20) moderately expanded.

Pronotum (Fig. 29): cordate, strongly contracted from penultimate marginal tubercle almost to base, sides with 3 irregular teeth in anterior half, posterior tooth small, often smaller than median; front margin strongly produced, thickened and shining; upper surface uneven but not tuberculate, sides and base of disc slightly raised; densely reticulately microsculptured and irregularly sparsely punctured with large and small punctures, interspaces half–4 times diameter.

Elytron (Figs 1, 12): uneven, with 4 massive, acutely raised, and 2–4 smaller tubercles; 3 of large tubercles in row near elytral suture, furthest with another large tubercle outside it; largest tubercles *c.* half height of elytron at humerus, the latter also strongly raised and laterally produced, with row of small tubercles along its apex; very densely microsculptured and dull except tubercles and a few scattered spots shining; elytral punctures large, deep, evenly distributed approximately 1 diameter apart. Scutellum shining. Metasternum fairly densely but shallowly punctured. Legs: ♂ with tarsal segments not expanded at base.

Male genitalia (Fig. 35): apex of aedeagal median lobe abruptly contracted to pointed mucronate tip; tegmen deeply keeled.

Female genitalia : spermathecal duct (Fig. 41) spirally coiled, apex receptaculum pointed; median ventral sclerite short, similar to *C. westwoodii*.

Distribution and biology. Cheiloxena tuberosa is a rare species of subtropical rainforests, distributed from Dorrigo, New South Wales to Mount Glorious, south Queensland.

A single specimen has been taken in a flight trap on *Argyrodendron actinophyllum*. Adults have been collected from November to February.

Cheiloxena westwoodii Baly

Figures 3, 8, 13, 14, 21-23, 30, 31, 36, 37, 42, 43, 45

Cheiloxena westwoodii Baly, 1860: 255, plate 14 figs 1–2.

Chiloxena westwoodi. — Clavareau, 1913: 6 (misspelling). — Jolivet, 1957: 99, fig. 13D.

Types. Lectotype (this designation): ♂ / Type / Type / Cheiloxena westwoodi [sic] Baly / Australia / (BMNH).

Paralectotype: ♀ / Type / Cheiloxena westwoodi [sic] Baly / Baly coll. 1879 / (BMNH).

Other material. Southern form (28). Vic.: Belgrave, Healesville, Mount Saint Bernard, Ringwood, Seville, Warburton.

ACT: Blundell Hill (Brindabella Range).

NSW: Island Bend (Kosciusko NP), Musfield [?].

Northern form (49). NSW: Barrington Tops, Blue Mountains, nr Cutters Pass (Williams R.), 17 km N Dorrigo, Dorrigo, Gibraltar Range National Park, Gosford, Hastings River, Middle Brother State Forest, Mount Tomah, Mount Victoria, Ourimbah, Robertson, Sydney, Ulong (nr Dorrigo).

Qld: Stanthorpe.

Diagnosis. Apical antennal segments elongate and parallel-sided, frons concave between antennal bases, pronotum with lateral tubercles and without dorsal keels, elytra with recumbent setae and with small to medium tubercles (up to third height of elytron at humerus) near suture.

Description. Entirely matt black with palpi and often lateral margins of elytra, tarsi and apical antennal segments, reddish-brown; wholly and variably densely clothed with slightly variegated pattern of dull yellowish or rarely silvery, pointed, adpressed scales; scales slightly narrower on pronotum than elytra; scales form series of small spots along outer elytral margin, most apical of which largest and proximal to margin; scutellum densely scaled; pronotal disc densely scaled; elytral tubercle scales slightly longer than other scales, and not more dense; elytra without erect setae; southern form usually with very densely scaled mesepisternum and posterior lateral corner of metasternum; body form subcylindrical, and head hypognathous, hooded by pronotum; length 8–12 mm.

Head (Fig. 3): whole of vertex densely with large punctures, interspaces reduced to ridges, dull; anterior margin of frontoclypeus triangu-

larly excavate in middle, sometimes less deeply concave, not laterally toothed between base of antenna and mandible; frons concave between antennal bases; antenna (Fig. 8) long, last 4 segments very elongate; ♂ last segment of maxillary palp (Figs 21–23) moderately expanded, slightly narrower in northern form but intermediates present (Fig. 22).

Pronotum (Figs 30, 31): cordate, weakly to strongly contracted from posterior marginal tubercle almost to base; sides with 3 irregular teeth in anterior half, rarely middle tooth absent and posterior tooth reduced; front margin strongly produced, thickened, and shining; upper surface uneven but not tuberculate, sides and base of disc slightly raised; densely reticulately microsculptured and densely punctured with large shallow punctures, interspaces reduced to ridges.

Elytron (Figs 13, 14): slightly uneven, with 4–9 variably raised tubercles, and up to 12 additional small tubercles; *northern form* with 5 large tubercles in row near elytral suture, row of 3 large tubercles outside the first, third and fourth of the inner row, and another large tubercle outside the third tubercle of the outer row, largest tubercles about third height of elytron at humerus; specimens from Robertson and Dorrigo (ANIC) with about 12 small but sharply raised tubercles between inner elytral row and outer margin; *southern form* with small tubercles in positions of 2 main rows of northern form, other tubercles minute or absent (in a specimen from Island Bend (ANIC) basal tubercles are elongate ridges reaching elytral base), largest tubercles less than quarter height of elytron at humerus; humerus also strongly raised and laterally produced, with slight tuberculation along its apex; very densely microsculptured and dull except shining apices of tubercles and a few scattered spots; elytral punctures large, deep, evenly distributed approximately 1 diameter apart. Scutellum dull, densely punctate. Metasternum fairly densely but shallowly punctured, interspaces third–half diameter of punctures. Legs: ♂ with basitarsal segments assymetrically expanded at base.

Male genitalia: aedeagus of northern (Fig. 37) and southern (Fig. 36) forms almost identical, with apex of median lobe abruptly contracted to pointed mucronate tip and tegmen deeply keeled; northern form with slightly broader apex to median lobe and slightly more deeply keeled tegmen.

Female genitalia: spermatheca of northern (Fig. 43) and southern (Fig. 42) forms apparently identical, with spiral duct and blunt tip. Median ventral lobe short (Fig. 45).

Distribution and biology. At present there is a gap of about 200 km in the distribution records of the two geographic forms, but since the species is rare this gap may not be significant.

Northern form: widespread on the Dividing Range and outlying highlands between Robertson, south of Sydney, New South Wales, and Stanthorpe, south Queensland.

Southern form: widespread on high ground from the central Victorian coastal hills to Brindabella Range, ACT.

The species has been beaten off the unrelated genera *Eucalyptus* (Myrtaceae) and *Astrotriche* (Araliaceae). Most specimens were collected from October to January.

Remarks. The original description of this species by Baly includes an excellent illustration of the habitus. *Cheiloxena westwoodii* is similar to *C. tuberosa* from which it differs in having smaller elytral tubercles and the pronotum less constricted basally from the posterior lateral tooth.

Two geographic forms can be distinguished, but are not separately named because not enough material is available from the potential area of overlap. The type material and description (Baly, 1860) are clearly of the northern form. The description above is of both forms unless otherwise noted.

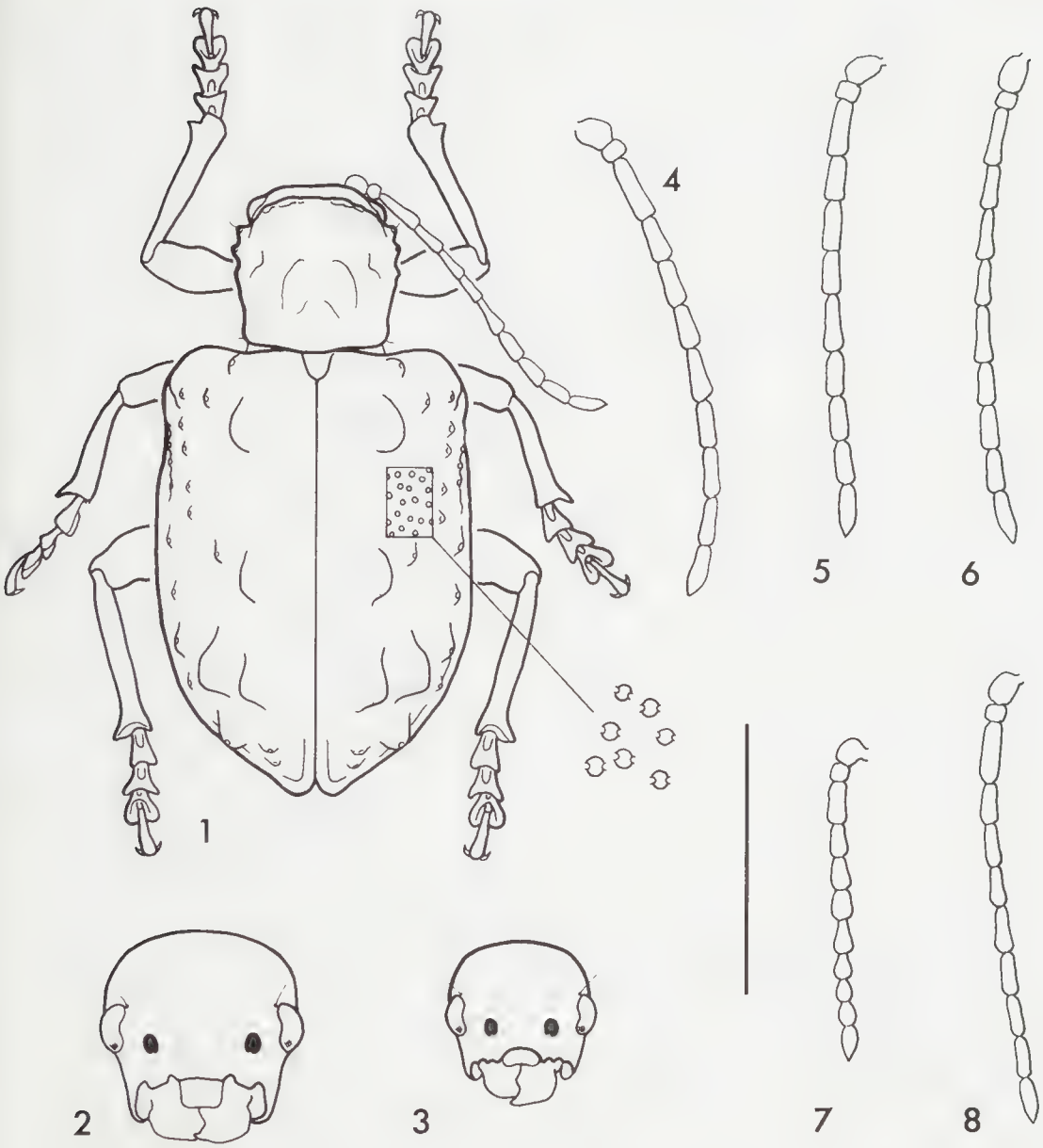
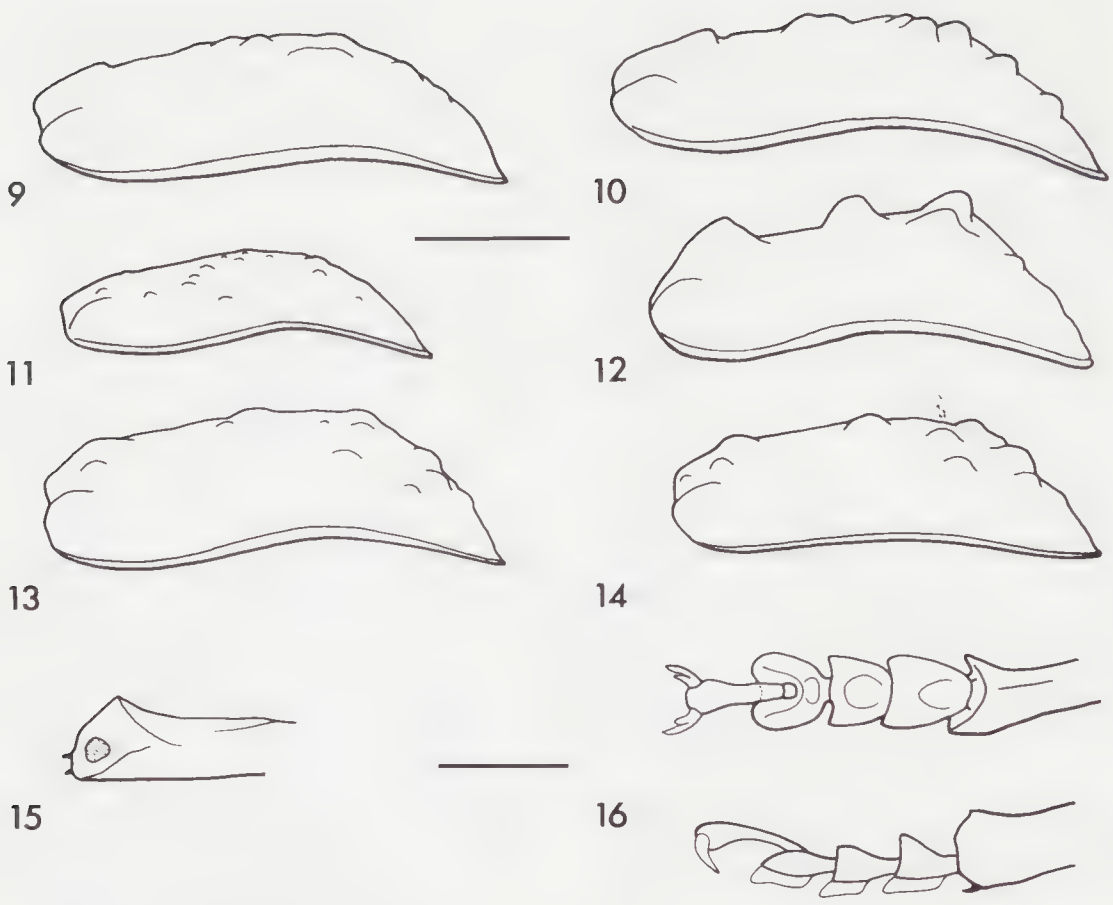


Figure 1. Habitus of ♀ *Cheiloxena tuberosa*, with detail of dorsal punctures.

Figures 2, 3. Anterior view of face of *C. blackburni* (2), and *C. westwoodii* (3).

Figures 4–8. ♂ antennae of *C. tuberosa* (4), *C. blackburni* (5), *C. frenchae* (6), *C. insignis* (7) and *C. westwoodii* (8). Scale bar = 5 mm.



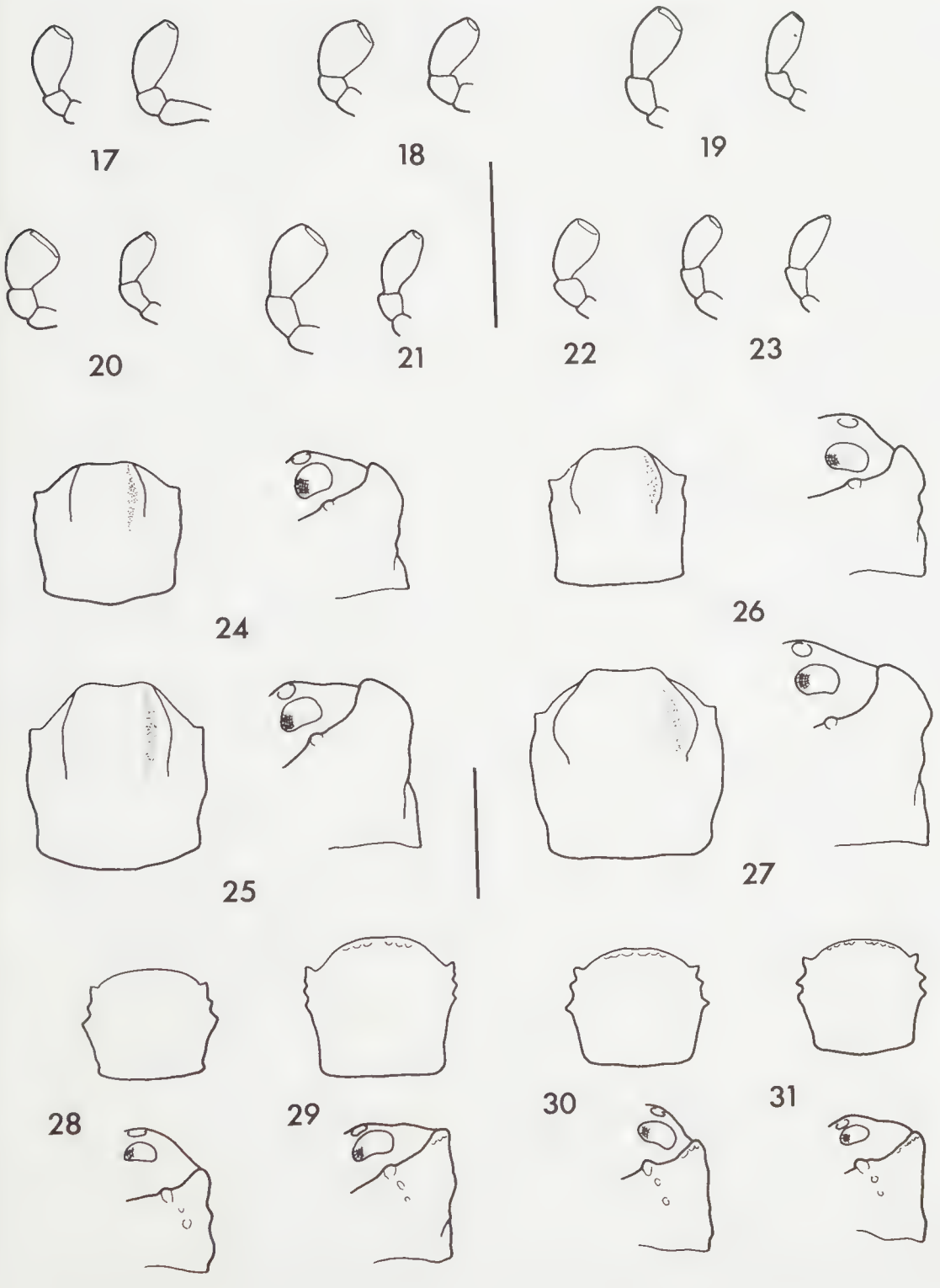
Figures 9–14. Lateral view of elytra of *Cheiloxena blackburni* (9), *C. frenchae* (10), *C. insignis* (11), *C. tuberosa* (12) and *C. westwoodii*, southern form (13) and northern form (14).

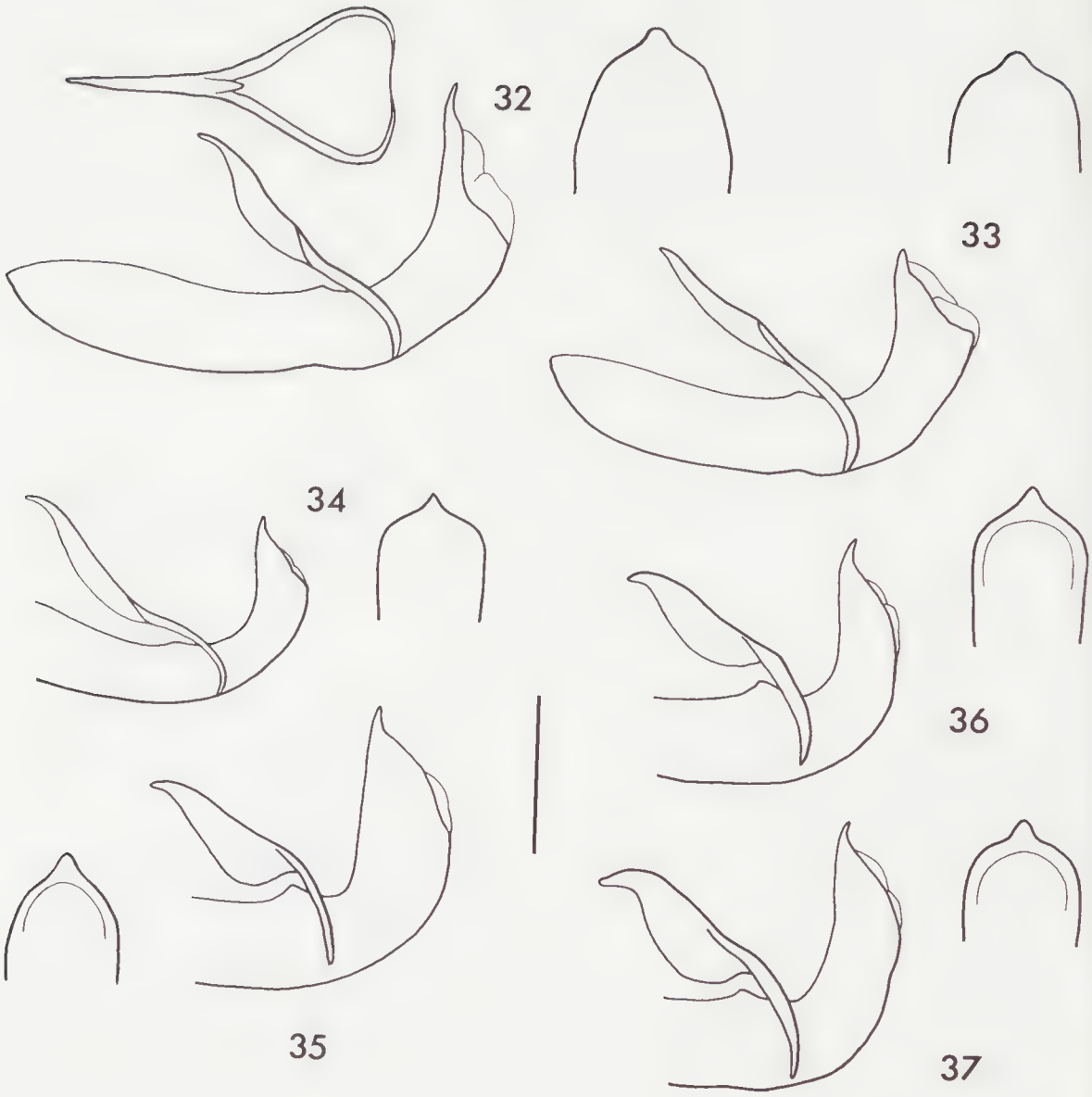
Figure 15. Tibial spurs at apex of metatibia of *C. insignis*.

Figure 16. Dorsal and lateral view of protarsus of *C. insignis*.

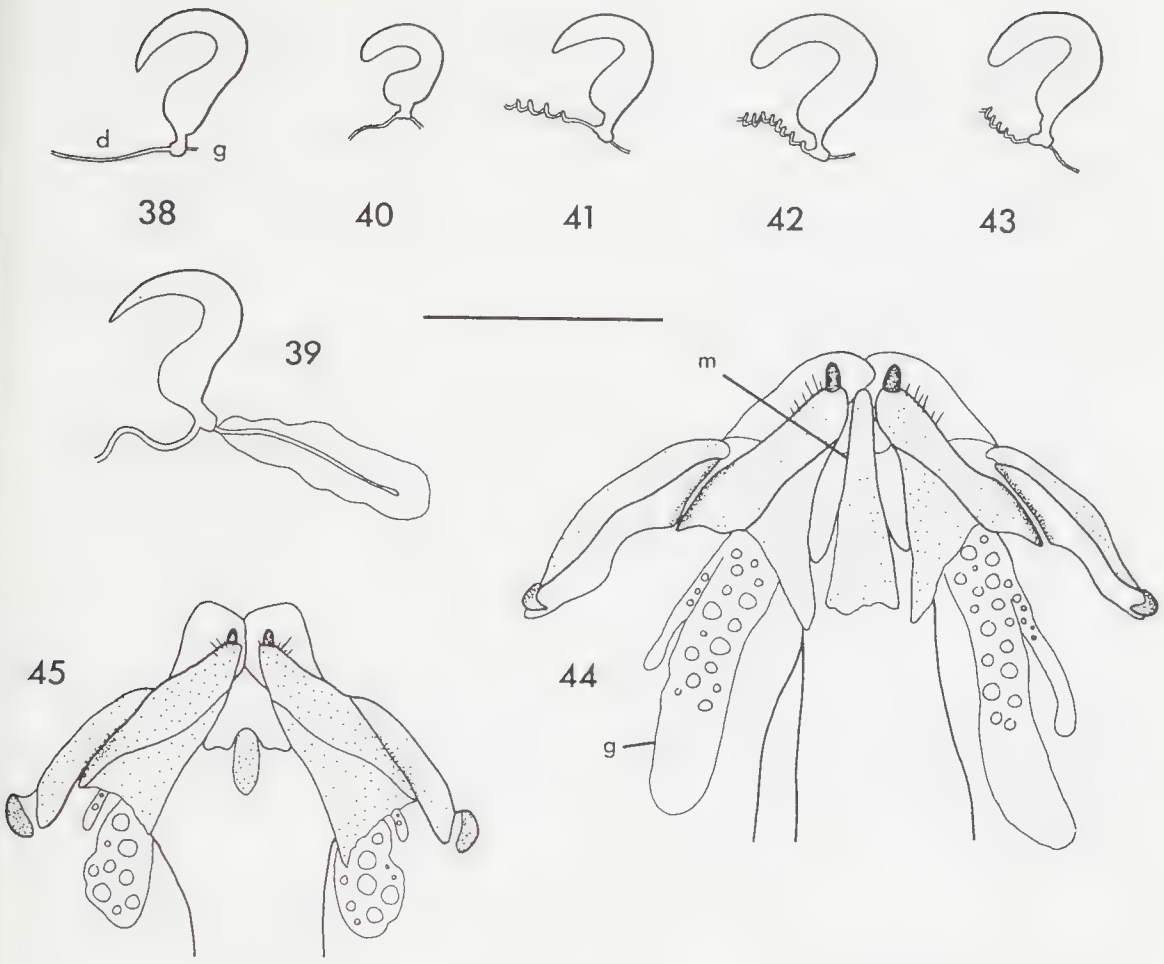
Scale bars = 3 mm (9–14) and 1 mm (15-16).

Figures 17–23. ♂ (left) and ♀ (right) apical maxillary palp segments of *Cheiloxena blackburni* (17), *C. frenchae* (18), *C. insignis* (19), *C. tuberosa* (20) and *C. westwoodii*, southern form (21) and northern form (22; Middle Brother State Forest, ♂ only) and (23; Dorrigo). Figures 24–31. Dorsal and lateral views of pronotum of *C. blackburni* (♂, 24. ♀, 25), *C. frenchae* (♂, 26. ♀, 27), *C. insignis* (28), *C. tuberosa* (29) and *C. westwoodii*, southern form (30) and northern form (31). Scale bars = 1 mm (17–23) and 3 mm (24–31).


17
18
19
20
21
22
23
24
26
25
27
28
29
30
31



Figures 32–37. Lateral and apicoventral views of aedeagus of *Cheiloxena blackburni* (32; including ventral view of tegmen), *C. frenchae* (33), *C. insignis* (34), *C. tuberosa* (35) and *C. westwoodii*, southern form (36) and northern form (37). Scale bar = 1 mm.



Figures 38–43. Spermatheca of *Cheiloxena blackburni* (38), *C. frenchae* (39), *C. insignis* (40), *C. tuberosa* (41) and *C. westwoodii*, southern form (42) and northern form (43). d = spermathecal duct, g = spermathecal gland. Figures 44, 45. Ventral view of ovipositor of *C. frenchae* (44) and *C. westwoodii*, southern form (45). g = vaginal gland, m = median ventral sclerite. Scale bar = 1 mm.

Discussion

Phylogeny of the species

The genus *Cheiloxena* is closely related to *Macrolema* Baly and *Richmondia* Jacoby, and these form a monophyletic group (Reid, in prep.). The genera share the following attributes, the first three of which are apparently synapomorphies: pronotum constricted to base and much narrower than elytra; lateral pronotal margins absent; last four antennal segments shorter and narrower than preceeding and covered with dense adpressed pubescence and microsculpture; first two abdominal ventrites connate; 1, 2 and 2 apical spurs on pro-, meso- and metatibia respectively.

A cladistic analysis of *Cheiloxena* species was made using species of *Macrolema* and *Richmondia* as outgroup (*Macrolema vittata* Baly, *Macrolema* (= *Macrogonus*) *quadrivittatus* Jacoby, and

Richmondia olliffi (Blackburn)). The characters used and their states are given in Table 1 and the matrix (of 6 taxa and 16 characters) in Table 2. The polarity of character 16 is guessed because in *Macrolema* and *Richmondia* this character is extremely reduced. In Table 1 characters 1–5 provide synapomorphies for *Cheiloxena*, states 10(1), 11(1) and 12(2) are autapomorphies for *C. insignis* and state 12(0) is autapomorphic for *C. tuberosa*. The species *C. blackburni* and *C. frenchae* are scored identically and if the phylogenetically uninformative autapomorphies are discounted, the data set is functionally of 5 taxa and 8 characters.

The minimum-length tree for the distribution of these 8 characters (6–9, 13–16) on the 5 taxa was 9 steps long, with Consistency Index of 0.89, found by branch-swapping with the program MACCLADE Version 2.1 (Maddison and Maddison, 1987) (Fig. 46). This cladogram shows that the species pair *C. blackburni*/*C. frenchae* is the sister group of the remaining species of *Cheiloxena* and that *C. insignis* is the sister species of the species pair *C. tuberosa*/*C. westwoodii*. In this hypothetical phylogeny of the species of *Cheiloxena* the shape of the spermathecal receptaculum is the only character which varies homoplasiously.

Table 2. Character matrix for *Cheiloxena* spp.

Taxon	Characters 1–16	
Outgroup	00000000?0	??0?01
C. blackburni	1111100110	010010
C. frenchae	1111100110	010010
C. insignis	1111111001	120001
C. tuberosa	1111111010	001101
C. westwoodi	1111111000	011101

Biogeography

All available records of the five species are plotted in Figure 47. The distributions of *C. blackburni*, *C. frenchae* and *C. insignis* are bimodal but these distribution patterns may be artifacts of collecting bias towards the vicinities of Sydney and Melbourne, because the species are relatively rare. *Cheiloxena tuberosa* is the only species of *Cheiloxena* associated with tropical rainforest despite the entire outgroup being restricted to this habitat. The phylogenetic position of *C. tuberosa* suggests that its presence in rainforest represents establishment in this habitat independent of the outgroup.

Table 1. List of characters and states for determination of phylogeny of *Cheiloxena* species.

Character	Plesiomorphic state (0 unless otherwise indicated)	Apomorphic state (1 unless otherwise indicated)
1. Claws	simple	bifid
2. Tarsi	simple	hollowed
3. Dorsal punctures	simple	microtuberculate
4. Dorsum	metallic, smooth	dull, rugose
5. Dorsum	glabrous	scaled
6. Lateral pronotal teeth	absent (Fig. 24)	present (Fig. 28)
7. Deep excavation of frons	absent (Fig. 2)	present (Fig. 3)
8. Ridges on pronotum	absent (Fig. 28)	present (Fig. 24)
9. Apex of spermatheca	rounded (Fig. 40)	pointed (Fig. 38)
10. Apical antennal segments	elongate (Fig. 5)	moniliform (Fig. 7)
11. Scale-like setae	clavate	narrow
12. Elytral tubercles	prominent (Fig. 10) (1)	very large (Fig. 12) (0) very small (Fig. 11) (2)
13. Tegminal keel	shallow (Fig. 32)	deep (Fig. 35)
14. Spermathecal duct	simple (Fig. 38)	spiral (Fig. 41)
15. Apex median lobe aedeagus	pointed (Fig. 34)	blunt (Fig. 32)
16. Median sclerite of ovipositor	elongate (Fig. 44)	short (Fig. 45)

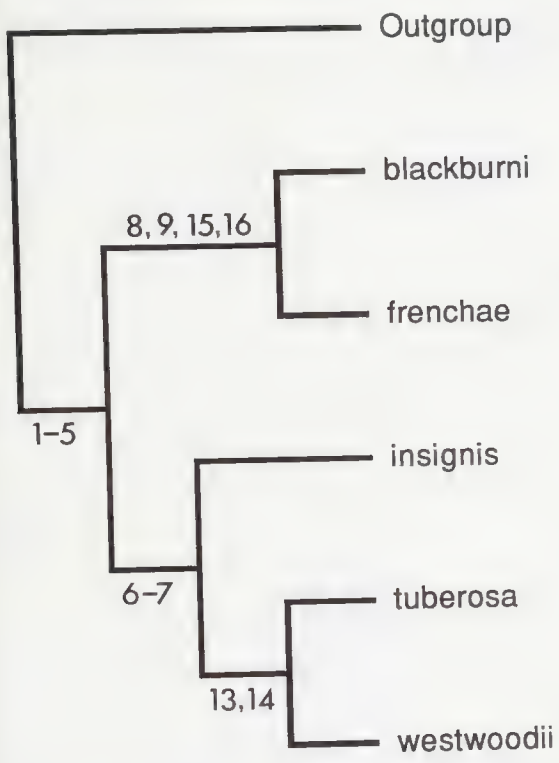


Figure 46. Phylogeny of *Cheiloxena* species. Numbers refer to apomorphic states of characters listed in Table 1.

Acknowledgements

I thank the following curators for the loan or examination of material in their care : Geoff Holloway (AM), John Lawrence (ANIC), Eric Matthews (SAM), Sharon Shute (BMNH) and Ken Walker (NMV). I thank Penny Gullan and John Lawrence for helpful criticism of the manuscript. This work was supported by the Australian Biological Resources Study.

References

Baly, J.S., 1860. Descriptions of some new species of *Sagra*; remarks on that genus; and the characters of *Cheiloxena*, a new genus belonging to the same family (concluded). *Transactions of the Entomological Society of London* (2) 5: 249–260.

Blackburn, T., 1893. Further notes on Australian Coleoptera, with descriptions of new genera and species. XIII. *Transactions of the Royal Society of South Australia* 17: 130–140.

Blackburn, T., 1896. Further notes on Australian Coleoptera, with descriptions of new genera and species. XIX. *Transactions of the Royal Society of South Australia* 20: 35–109.

Chapuis, F., 1874. *Histoire naturelle des Insectes. Genera des Coléoptères. X. Famille des Phytophages.* iv + 555 pp. Paris.

Clavareau, H., 1913. Chrysomelidae: 1. Sagrinae, 2. Donaciinae, 3. Orsodacninae, 4. Criocerinae. *Coleopterorum Catalogus* 51: 1–103.

Crowson, R.A., 1946. A revision of the chrysomelid group Sagrinae (Coleoptera). *Transactions of the Royal Entomological Society of London* 97 (4): 75–115.

Gemminger, M. and von Harold, E., 1874. [Chrysomelidae pars 1]. *Catalogus Coleopterorum hucusque descriptorum synonimicus et systematicus* 11: 3233–3478.

Jacoby, M., 1903. Coleoptera Phytophaga. Sect. Eupoda. Fam. Sagridae. *Genera Insectorum* 14: 1–11, plate 1.

Jolivet, P., 1950. Rectifications de nomenclature chez les Chrysomeloidea. *Bulletin de l'Institut Royal des Sciences Naturelles de Belgique* 26 (56): 1–4.

Jolivet, P., 1957. Recherches sur l'aile des Chrysomeloidea (Coleoptera). Première partie. *Mémoires de l'Institut royale des Sciences naturelles de Belgique* 2 (51): 1–180.

Maddison, W.P. and Maddison, D.R., 1987. *MacClade, version 2.1.* A phylogenetic computer program distributed by the authors. 55 pp.

Seeno, T.N. and Wilcox, J.A., 1982. Leaf beetle genera (Coeoptera: Chrysomelidae). *Entomography* 1: 1–221.

Selman, B.J., 1963. A revision of the genus *Deretrichia* Weise (Coleoptera: Eumolpidae). *Bulletin of the British Museum (Natural History), Entomology* 14 (4): 155–196.

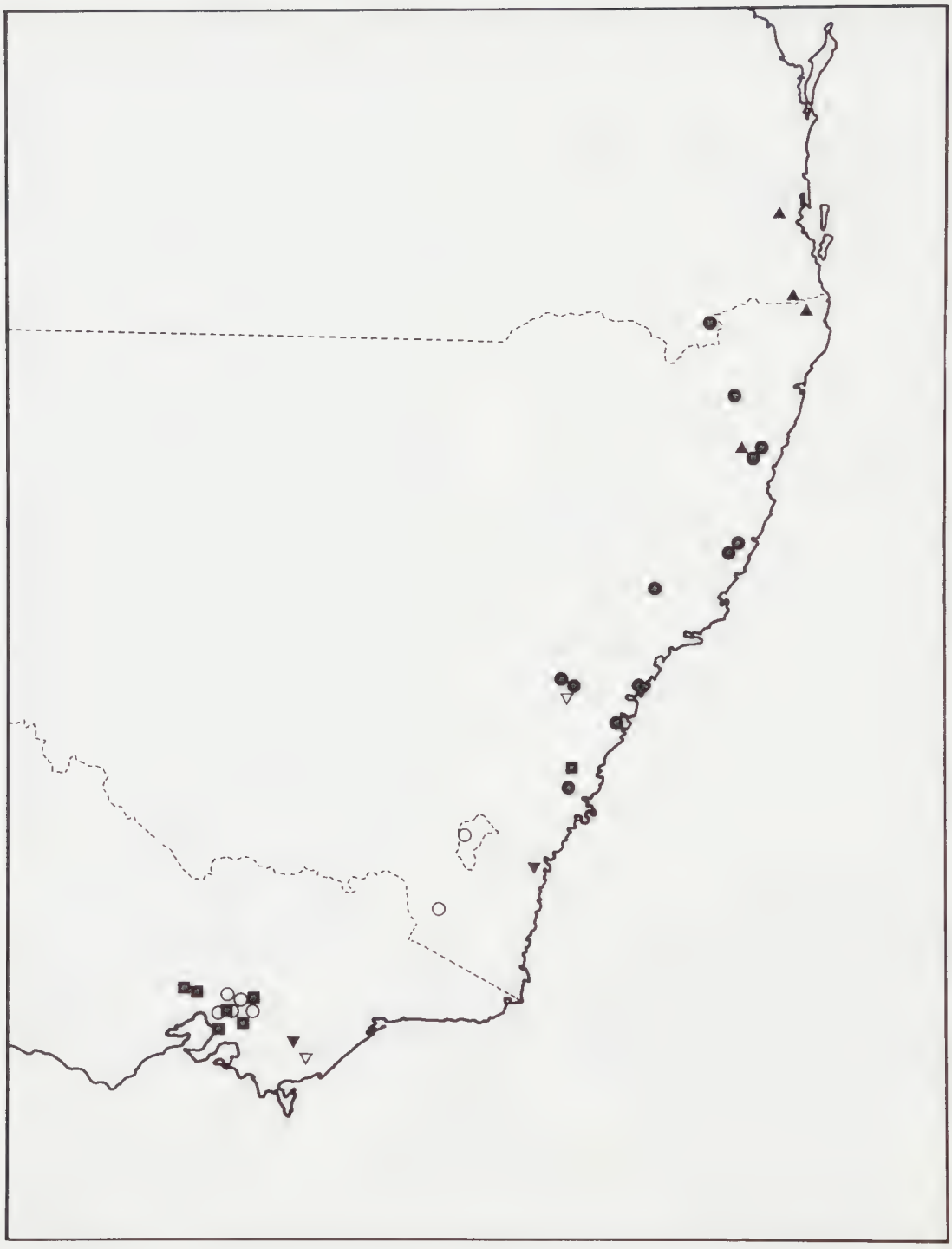


Figure 47. Map of south-eastern Australia showing distribution of *Cheiloxena* spp. ▽ = *C. blackburni*; ▼ = *C. frenchae*; ■ = *C. insignis*; ▲ = *C. tuberosa*; ○ = *C. westwoodii*, southern form; ● = *C. westwoodii*, northern form.

Memoirs of the Museum of Victoria 53(1): 115–123 (1992)

THYSANOPTERA (INSECTA) FROM THE 1985 AND 1986 ZOOLOGICAL EXPEDITIONS TO THE KRAKATAUS, INDONESIA

By Richard zur Strassen

Forschungsinstitut Senckenberg, Senckenberg-Anlage 25, D-6000 Frankfurt am Main, Germany

Abstract

zur Strassen, R., 1992. Thysanoptera (Insecta) from the 1985 and 1986 Zoological Expeditions to the Krakataus, Indonesia. *Memoirs of the Museum of Victoria* 53: 115–123.

The Thysanoptera collections of the La Trobe University/LIPI 1985 and 1986 Zoological Expeditions to the Krakatau islands in the Sunda Strait, Indonesia, include 26 species. Two species are described as new and figured: *Mymarothrips bicolor* sp. nov., and *Apollothrips karnyi* sp. nov. A further five species are recorded from Indonesia for the first time: *Anisopilothrips venustulus* (Priesner), *Apollothrips bhattii* Wilson, *Panchaetothrips holtmanni* Wilson, *Plectrothrips eximius* Ananthakrishnan, and *Strepterothrips orientalis* Ananthakrishnan.

Introduction

The 1985 and 1986 Zoological Expeditions to the Krakataus in the Sunda Strait, Indonesia, during August (1985) and September (1986), were carried out by zoologists from Indonesian and Australian institutions. A general introduction to the 1984 and 1985 expeditions was provided by Thornton and Rosengren (1988). A report on the Thysanoptera collected on the 1984 expedition was presented by zur Strassen (1991).

About two dozen samples of thrips (Thysanoptera) were collected in 1985, and four samples in 1986. One 1984 sample is included in the present paper.

The thysanopterans were obtained mainly by beating and sweeping vegetation, and in a few cases by Malaise traps. Many specimens are damaged, several of them have the antennae or parts of them broken off. Therefore, not all specimens have been identified to species.

Material is deposited in the Lembaga Ilmu Pengetahuan Indonesia (LIPI), the Forschungsinstitut Senckenberg at Frankfurt am Main, Germany (SMF) and the Museum of Victoria, Melbourne, Australia (NMV).

The species dealt with below are arranged systematically under families. Within these the genera are arranged alphabetically as are the species under each genus.

Aeolothripidae

Mymarothrips bicolor sp. nov.

Figure 1

Material examined. Holotype: Krakataus, Panjang I., by sweeping (235-D2B), 17 Aug 1985, LIPI (female).

Paratype: Krakataus, Sertung I., by beating twigs in forest (244-CS), 18 Aug 1985, SMF (1 female).

Diagnosis. Head about as long as broad. Body 2-coloured, anterior part of body largely pale yellow, abdominal segments V–X brown to dark brown, margins of head darkened; forewings white in proximal half, brown in distal half with large circular colourless apical patch; dorsal setae on abdominal segments IX and X yellowish.

Description (female macropterous). Total length (distended) 1470–1550 µm. Head between the eyes yellow, anterior margin and cheeks as deep as eyes width brown, mouth cone yellow; antennae dark brown, segments I and VII–IX a trifle paler. Pronotum yellow with lateral margins brownish, setae pale. Pterothorax and abdominal segments I–III pale yellow, segment III with small pale brown spot near lateral margin just behind subbasal transverse line, segment IV pale brown mottled posteriorly or laterally, otherwise yellow, segments V–VII coloured as in IV, or uniformly brown, segment VIII somewhat darker than VII or even dark brown as abdominal segments IX and X; setae on latter 2 segments yellowish. Legs pale yellow. Forewings (Fig. 1) white in proximal half including veins, setae and scapus, brown in distal half except for large circular white patch almost at apex, vein setae in this part dark brown; hindwings similarly coloured, but the brown of a slightly paler tinge and the white patch not as clearly marginated as in forewing.

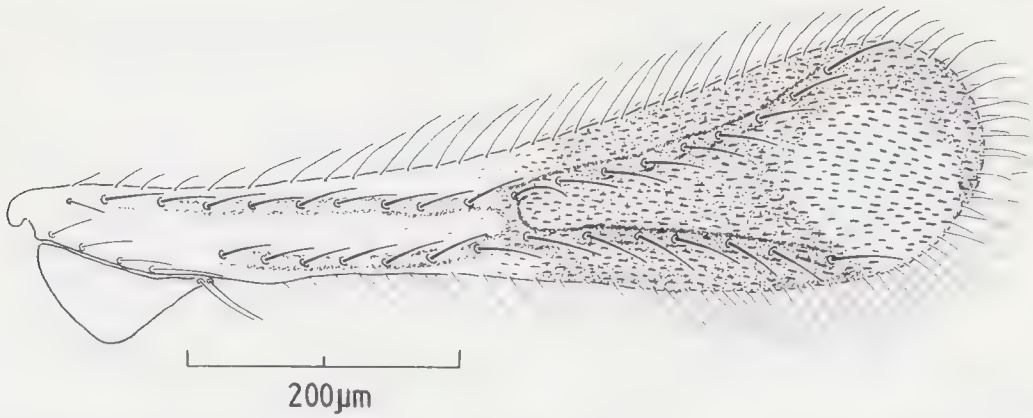


Figure 1. *Mymarothrips bicolor* sp. nov., holotype female, LIPI (right fore wing showing the colour pattern as seen by means of phase contrast. Drawn by Andrea Vesmanis.

Head about as long as broad, ante-ocular seta dark brown, 38–41 µm long, other head setae pale. Length in µm of antennal segments of holotype: I 31, II 49, III 84, IV 64, V 59, VI 54, VII 57, VIII 19, IX 17. Pronotum 139–154 µm long, 178–205 µm broad, subanteromarginal setae as long as or somewhat longer (57–69 µm) than anteromarginals (51–56 µm), posteroangular setae 74–86 µm long. Pterothorax 300–318 µm long, 270–298 µm broad; hind tibia 218–230 µm, hind tarsus 103–115 µm long. Forewing 820–880 µm long, across middle 107–115 µm broad, before apex 192–215 µm broad, distance between anterior and posterior vein at crossvein 17–23 µm, apical setae of posterior vein 63–75 µm long. Abdominal segments IX+X together 225–240 µm long, width across base of segment IX 146–161 µm; segment IX with seta S_1 126–129 µm, S_2 138–149 µm, dorsal seta 86 µm long, segment X with seta S_1 115–121 µm long. Sternite VI with 4–6, sternite VII with 10–13 accessory setae. Ovipositor 355–375 µm long.

Discussion. The new species *M. bicolor* is readily distinguished from its congeners by the colouration. The type species, *M. ritchianus* Bagnall (1928) from the Ethiopian region, is a generally pale species with orange and red internal pigmentation; pterothorax at lateral margin, meso- and metasternum, abdominal segments I, distal half of IX and all of X are yellowish brown; the forewing is very pale brownish at its base, the third and fourth fifth has a slightly darker tinge at the level of the cross vein between anterior and posterior vein, and across the broadest part of the wing. The two species from the Oriental region, *M. bolus* Bhatti, 1967 and *M. garuda* Ramakrishna and Margabandhu, 1931 are much darker than the new species and have dark setae all along the veins of the forewing, the costa of which is dark in its total length.

Thripidae

Anisopilothrips venustulus (Priesner)

Heliothrips venustulus Priesner, 1923: 89.
Anisopilothrips venustulus. — Stannard and Mitri, 1962: 187.

Material examined. Krakataus: Panjang I., by sweeping (164-N), Sep 1984, LIPI (1 female).

Distribution. Perhaps of Caribbean origin, introduced to many subtropical and tropical islands and several countries near the sea; foliicolous. Not previously recorded from Indonesia.

Apollothrips bhattii Wilson

Apollothrips bhattii Wilson, 1972: 52.

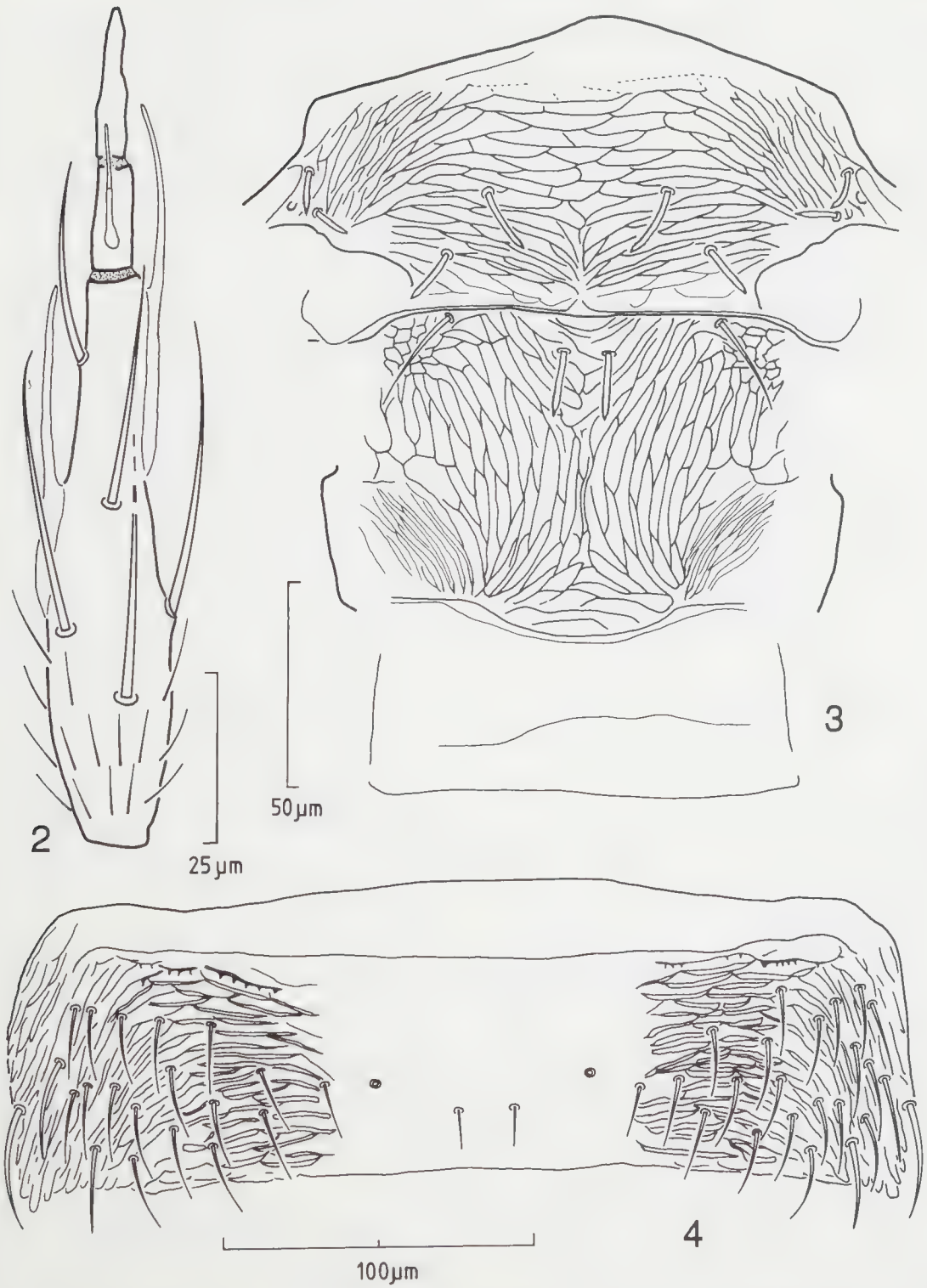
Material examined. Krakataus: Panjang I., by sweeping (164-N), Sep 1984, LIPI (1 female); Panjang I., by sweeping (330-CE), 25 Sep 1986, SMF (1 male). Sertung I., Spit, by beating in the transition zone (244-HM), NMV (1 female), and by sweeping in forest (245-L2C), both 18 Aug 1985, LIPI, SMF (2 females); Panjang I., South Ridge, by sweeping in forest (340-DD), 27 Sep 1986, NMV (1 female).

Distribution. Until now known only from the type series from Madhya Pradesh, India; perhaps living on ferns.

Apollothrips karnyi sp. nov.

Figures 2–4

Material examined. Holotype: Krakataus, Sertung I.,



Figures 2–4. *Apollothrips karnyi* sp. nov., holotype female (LIPI). 2, antennal segment VI dorsally; 3, meso- and metanotum; 4, tergite VI. Drawn by Andrea Vesmanis.

Material examined. Krakataus: Rakata I., Owl Bay, by sweeping from low coastal vegetation (225-JI), 25 Aug 1985, LIPI (1 male). Anak Krakatau I., West shore, from Malaise trap (313-EM), 24 Sep 1986, NMV (1 male). Sertung I., South Ridge, by sweeping in forest (340-DD), 27 Sep 1986, LIPI, SMF (2 males).

Distribution. Japan, Taiwan, Sumatra, Java, Vanuatu (= New Hebrides), Tonga; floricolous.

Panchaetothrips holtmanni Wilson

Panchaetothrips holtmanni Wilson, 1975: 186.

Material examined. Krakataus: Panjang I., by sweeping low vegetation (235-EU), 16 Aug 1985, LIPI (1 female); Panjang I., NE shore, by sweeping (235-BH), 17 Aug 1985, SMF (1 female). Sertung I., South Ridge, by sweeping in forest (340-DD), 27 Sep 1986, NMV (1 female).

Distribution. Until now known only from the type material from New Guinea; foliicolous.

Remarks. The three specimens are regarded as belonging to *P. holtmanni* because of the forked sense cones on antennal segments III and IV (not mentioned in the original description because only segments I and II are present in the type specimens); the weak and pale seta S_1 on hind margin of tergite II which is about half as long as seta S_2 (not as strong and long as); the subbasal (antecostal) line on tergites II–VIII with many posteriorly directed small notches; and the discal campaniform sensilla on metanotum being separated by more than two of their own diameters. However, in none of the specimens dealt with is there a minute seta midway between the posterior ocelli and the eyes as has been described for the type specimens.

Scirtothrips dorsalis Hood

Scirtothrips dorsalis Hood, 1919: 90.

Material examined. Krakataus: Anak Krakatau I., from Malaise trap at outer cone (213-SJ), 18 Aug 1985, LIPI (1 female); Anak Krakatau I., from Malaise trap NE foreland (213-PK), 19 Aug 1985, SMF (1 male).

Distribution. From Japan, New Guinea, the Solomons and Australia, westward to Pakistan, also S. Africa (perhaps introduced); floricolous/foliicolous.

Selenothrips rubrocinctus (Giard)

Physopus rubrocincta Giard, 1901: 264.
Selenothrips rubrocinctus. — Hood, 1913: 150.

Material examined. Krakataus: Anak Krakatau I., by beating broad leaved plants (214-FD), LIPI, SMF, NMV (7 females), and by another beating broad leaved plants (214-GG), 21 Aug 1985, LIPI (1 female).

Distribution. Circum-subtropical and -tropical; foliicolous.

Thrips hawaiiensis (Morgan)

Euthrips hawaiiensis Morgan, 1913: 3.
Thrips hawaiiensis. — Priesner, 1934: 266.

Material examined. Krakataus: Anak Krakatau I., from Malaise trap on outer cone (213-SJ), 18 Aug 1985, LIPI (1 female).

Distribution. Southern States of USA, Pacific, Japan, Oriental Region; floricolous, polyphagous.

Zonothrips karnyi Priesner

Zonothrips karnyi Priesner, 1926: 260.

Material examined. Krakataus: Anak Krakatau I., by sweeping (215-EL), 22 Aug 1985 (LIPI), 1 female.

Distribution. Indonesia (Java); recently recorded from Rakata I. (zur Strassen, 1991).

Phlaeothripidae

Ecacanthothrips tibialis (Ashmead)

Idolothrips tibialis Ashmead, 1905: 20.
Ecacanthothrips tibialis. — Palmer and Mound, 1978: 156.

Material examined. Krakataus: Panjang I., by sweeping low vegetation (235-EU), 16 Aug 1985, LIPI (2 females). Rakata I., Owl Bay, by sweeping low coastal vegetation (225-JI), 25 Aug 1985, NMV (1 female).

Distribution. Indo-Australian Region, Japan, Mauritius, Rodrigues I., Tanganyika; fungivorous.

Elaphrothrips curvipes Priesner

Elaphrothrips curvipes Priesner, 1929: 206.

Material examined. Krakataus: Sertung I., Spit, by beating in *Casuarina* forest (244-AN), LIPI (1 male and 3 females), same locality, by beating a *Casuarina* tree (244-IO), NMV (1 male), and by sweeping understory in *Casuarina* forest (245-AH), LIPI (1 female), all 18 Aug 1985. Anak Krakatau I., by beating broad leaved plants (214-FD), LIPI, SMF (2 males and 1 female), and by another beating broad leaved plants (214-GG), NMV (1 male and 1 female), all 21 Aug 1985.

Distribution. Southeast Asia inclusive of Indonesia; fungivorous.

South Ridge, by sweeping in forest (340-DD), 27 Sep 1986, LIPI (female).

Diagnosis. Mouth cone 1.7 times as long as pronotum; discal setae on pronotum thin, not thickened; mesonotum in median third with sculpture of anastomosing transverse lines; tergites II–VII smooth in median part between the 2 setae S_2, no transverse lines around area of setae S_1, discal campaniform sensilla on tergites IV–VIII situated further cephalad than setae S_1.

Description (female macropterous). Total length (distended) 1520 µm. Head, pro- and pterothorax dark greyish brown, metanotum along midline with narrow longitudinal paler area, tergites medially and sternites grey brown, tergites fading laterad to almost white. Antennae dark brown, segments IV–VI immediately behind their basal margin each with narrow, transverse whitish band. Legs pale yellow; wings brown or greyish brown. Body setae pale brown, those on abdominal segments IX and X dark brown.

Head about 1.4 times as broad (160 µm) as long (115 µm). Dorsal surface densely sculptured with anastomosing transverse lines, setae short, not longer than 18 µm. Mouth cone almost pointed, 220 µm long, surpassing hind margin of pronotum, maxillary palpi 69 µm long. Antennae about 410 µm long (length of segments II and III in the unique specimen not exactly to measure), segments III and IV bottle-shaped, each with stout, forked sense cone with 57–63 µm long branches. Inner and outer sense cone on segment VI (Fig. 2) arising from long linear base, that of the inner cone 17 µm, that of the outer cone 29 µm long, the free distal part of the inner cone 31 µm, that of the outer cone 26 µm long.

Pronotum 155 µm long, 161 µm broad across anterior margin, 212 µm broad across widest part; surface with often anastomosing transverse lines of which 40 cross the longitudinal midline, and with about 60 short discal setae which are not thickened; hind margin without pronounced setae. Pterothorax 298 µm long, 270 µm broad. Mesonotum (Fig. 3) in its median part with same type of sculpture as on pronotum; metanotum without campaniform sensilla. Hind tibia 200 µm long; forewings slender, 875 µm long, 98 µm broad across scapus, 38 µm across middle, anterior vein with 3+6 (-7) subbasal setae and 2 distal setae, latter very close to tip of wing, posterior vein with 20 setae.

Abdominal tergites II–VII smooth in whole area between the 2 setae S_2 (see Fig. 4), no short transverse lines around setae S_1; discal campaniform sensilla on tergites IV–VII situated further cephalad than setae S_1; lateral parts of tergites with 12–20 setae laterad of seta S_2; ctenidia wanting. Abdominal segments IX+X together 161 µm long, dorsally without sculpture, seta S_1 on IX 69 µm, S_2 75 µm, dorsal seta 55 µm long, seta S_1 on X 92 µm, S_1 77 µm long. Ovipositor 260 µm long.

Etymology. The species is dedicated to Prof. Dr. H. Karny (1886–1939), the famous entomologist who for decades studied the Indonesian Thysanoptera.

Discussion. The new species *A. karnyi* is separated from *A. bhattii* Wilson, 1972, hitherto the only known species in the genus, by the longer mouth cone (220 µm; in *A. bhattii* 140–160 µm); by the normal shape of the discal setae on pronotum (not being stout and thickened); by the different sculpture of the mesonotum where the transverse lines are often anastomosing (instead of hardly anastomosing and running very closely); by the smooth median part of tergites II–VII between the setae S_1 (instead of short transverse lines around the setae S_1); by the location of the discal campaniform sensilla on tergites IV–VIII, situated further cephalad than setae S_1 (instead of further caudad, as in *A. bhattii*).

Astrothrips globiceps (Karny)

Heliothrips globiceps Karny, 1913a: 125.
Astrothrips globiceps. — Karny, 1923: 331.

Material examined. Krakataus: Sertung I., South Ridge, by sweeping in forest (340-DD), 27 Sep 1986, LIPI (1 female).

Distribution. Melanesia to southeast Asia; foliicolous. Just recently recorded from Sertung I. and Rakata I. (zur Strassen, 1991).

Dorcadothrips trifasciatus (Priesner)

Taeniothrips trifasciatus Priesner, 1936: 323.
Dorcadothrips trifasciatus. — Bhatti, 1978: 169.

Material examined. Krakataus: Rakata I., Owl Bay, from Malaise trap (223-AJ), 27 Aug 1985 (LIPI), 1 female.

Distribution. This is the first record of the species since its description from Sumatra, Wai Lima (Lampongs); perhaps foliicolous.

Megalurothrips formosae (Moulton)

Taeniothrips formosae Moulton, 1928: 298.
Megalurothrips formosae. — Bhatti, 1969: 241.

Ethirothrips stenomelas (F. Walker)

Phloeothrips stenomelas Walker, 1859: 224.
Ethirothrips stenomelas. — Mound and Palmer, 1983: 57.

Material examined. Krakataus: Panjang I., by sweeping low vegetation (235-EU), 16 Aug 1985, LIPI (1 female).

Distribution. Pacific, Indo-Australian Region, India, Madagascar; sporophagous.

Haplothrips certus Priesner

Haplothrips certus Priesner, 1929: 194.

Material examined. Krakataus: Anak Krakatau I., from Malaise trap on outer cone (213-SJ), 18 Aug 1985, LIPI (1 male).

Distribution. New Guinea, S. China, Taiwan, Sumatra, Mentawei Archipelago; on Cyperaceae.

Haplothrips ganglbaueri Schmutz

Haplothrips ganglbaueri Schmutz, 1913: 1034.

Material examined. Krakataus: Anak Krakatau I., by beating grasses (214-EF), 21 Aug 1985, LIPI (1 female).

Distribution. West Pacific, Oriental Region; graminicolous.

Holurothrips ornatus Bagnall

Holurothrips ornatus Bagnall, 1914b: 376.

Material examined. Krakataus: Panjang I., by sweeping low vegetation (235-EU), 16 Aug 1985, LIPI (1 female).

Distribution. Oriental Region; sporophagous.

Machatothrips antennatus (Bagnall)

Adiaphorothrips antennatus Bagnall, 1915: 594.
Machatothrips antennatus. — Mound, 1968: 133.

Material examined. Krakataus: Rakata I., S. Face, by beating (224-GL), 25 Aug 1985 (LIPI), 1 male.

Distribution. S. China, Malaya, Singapore, W. Sarawak, Indonesia; sporophagous.

Meiothrips menoni Ananthakrishnan

Meiothrips menoni Ananthakrishnan, 1964b: 99.

Material examined. Krakataus: Panjang I., by sweeping low vegetation (235-EU), 16 Aug 1985, LIPI (1 male).

Distribution. Oriental Region; sporophagous.

Nesothrips brevicollis (Bagnall)

Oedemothrips brevicollis Bagnall, 1914a: 29.
Nesothrips brevicollis. — Mound, 1968: 140.

Material examined. Krakataus: Panjang I., by sweeping (164-N), Sep 1984, LIPI (1 female–brachypterous). Sertung I., Spit, by beating in *Casuarina* forest (244-AN), 18 Aug 1985, LIPI, SMF, NMV (1 male–macropterous, 1 female–macropterous and 1 female–brachypterous); same island, forest, by sweeping (245-L2C), 19 Aug 1985, SMF (1 male–hemimacropterous). Anak Krakatau I., by beating from broad leaved plants (214-FD), 21 Aug 1985, LIPI, NMV (1 female–macropterous and 1 female–brachypterous).

Distribution. Old World tropics and subtropics; sporophagous.

Nesothrips lativentris (Karny)

Rhaebothrips lativentris Karny, 1913b: 129.
Nesothrips lativentris. — Pound and Palmer, 1983: 48.

Material examined. Krakataus: Sertung I., Spit, by beating in the transition zone (244-BP), 18 Aug 1985, LIPI (1 male–brachypterous). Anak Krakatau I., by beating broad leaved plants (214-GG), 21 Aug 1985, LIPI, NMV (1 female–macropterous and 1 female–brachypterous).

Distribution. Old and New World tropics; sporophagous.

Plectrothrips eximius Ananthakrishnan

Plectrothrips eximius Ananthakrishnan, 1969: 296.

Material examined. Krakataus: Rakata I., Owl Bay, from Malaise trap (223-AJ), 27 Aug 1985, LIPI (1 female). Anak Krakatau I., from Malaise trap (313-CN), 24 Sep 1986, SMF (1 female).

Distribution. Described from a unique female from Madras, S. India; fungivorous. Okajima (1981: 319) gave an additional record from Singapore.

Remarks. The two specimens from the Krakataus differ to some extent from the type specimen but nevertheless are regarded as belonging to *P. eximius*. The body colour is uniform dark, there are no yellow tinged portions, even the legs are dark brown, only the distal parts of the tibia are somewhat paler, the tube has a tinge of red.

Pygothrips vicinus Okajima

Pygothrips vicinus Okajima, 1990: 97.

Material examined. Krakataus: Sertung I., Spit, by

beating in *Casuarina* forest (244-AN), 18 Aug 1985, LIPI, SMF, NMV (6 females).

Distribution. Ryukyu Islands (Japan), Java, Thailand; sporophagous.

Remarks. The epimeral suture is complete in these six females whereas it is described as incomplete in the type material.

Strepterothrips orientalis Ananthakrishnan

Strepterothrips orientalis Ananthakrishnan, 1964a: 118.

Material examined. Krakataus: Anak Krakatau I., from Malaise trap (313-CN), 24 Sep 1986, LIPI (1 female–macropterous).

Distribution. Hawaii, Fiji, Taiwan, Thailand, S. India. Not previously recorded from Indonesia.

Streptothrips mirabilis Priesner

Streptothrips mirabilis Priesner, 1932: 58.

Material examined. Krakataus: Sertung I., Spit, by beating in *Casuarina* forest (244-AN), 18 Aug 1985, LIPI (1 female).

Distribution. This is the first record of the species since its description from Sumatra, Wai Lima (Lampongs).

Discussion

In a first report (zur Strassen, 1991) on Thysanoptera recently collected from the Krakataus 25 species were recorded from the 1984 Expedition to this island group in the Sunda Strait. The second report on newly submitted material deals with 26 species mostly taken on the 1985 Expedition to the archipelago. The new material contains a further 15 species not previously recorded from the Krakataus; eight of these species are also additions to the known fauna of Indonesia, of which two species are even newly described (*Mymarothrips bicolor* sp. nov., *Apollothrips karnyi* sp. nov.). Two species are recorded here for the first time since they were described long ago, i.e. *Dorcadothrips trifasciatus* Priesner, 1936 and *Streptothrips mirabilis* Priesner, 1932.

Fourteen (58%) of the species are represented by only a single specimen. The corresponding percentage for the 1984 material was 36%.

Acknowledgements

The author is grateful to Professor I.W.B. Thornton, Head of the Department of Zoology, La Trobe University at Bundoora, Victoria, Australia, and to Mr P.A. Vaughan, Research Assistant on the Krakatau Expeditions, for making this material available. Thanks are due also to the participants of the 1985 and 1986 Expeditions for collecting the specimens, and to the many sponsors for having rendered the project possible.

References

Ananthakrishnan, T.N., 1964a. Thysanopterologica Indica — I. *Entomologisk Tidskrift* 85 (1–2): 99–120.

Ananthakrishnan, T.N., 1964b. A contribution to our knowledge of the Tubulifera (Thysanoptera) from India. *Opuscula entomologica Supplementum* 25: 1–120.

Ananthakrishnan, T.N., 1969. Mycophagous Thysanoptera — II. *Oriental Insects* 3 (3): 289–299.

Bagnall, R.S., 1914a. Brief descriptions of new Thysanoptera – II. *Annals and Magazine of Natural History* (8) 13: 22–31.

Bagnall, R.S., 1914b. Brief descriptions of new Thysanoptera – IV. *Annals and Magazine of Natural History* (8) 14: 375–381.

Bagnall, R.S., 1915. Brief descriptions of new Thysanoptera – VI. *Annals and Magazine of natural History* (8) 15: 588-597.

Bagnall, R.S., 1928. Preliminary description of *Mymarothrips ritchianus*, a new type of Thysanopteron. *Annals and Magazine of Natural History* (10) 1: 304–307.

Bhatti, J.S., 1967. *Thysanoptera Nova Indica.* pp 23. Published privately by the author, Delhi, 11 March 1967.

Bhatti, J.S., 1969. The taxonomic status of *Megalurothrips* Bagnall (Thysanoptera: Thripidae). *Oriental Insects* 3 (3): 239–244.

Bhatti, J.S., 1978. A preliminary revision of *Taeniothrips* (Thysanoptera: Thripidae). *Oriental Insects* 12 (2): 157–199.

Giard, A., 1901. Sur un Thrips (*Physopus rubrocincta* nov. sp.) nuisible au Cacaoyer (Thys.). *Bulletin de la Société Entomologique de France* 1901 (15): 263–265.

Hood, J.D., 1913. On a collection of Thysanoptera from Porto Rico. *Insecutor Inscitiae Menstruus* 1 (12): 149–154.

Hood, J.D., 1919. On some new Thysanoptera from southern India. *Insecutor Inscitiae Menstruus* 7 (4–6): 90–103.

Karny, H., 1913a. Beitrag zur Thysanopteren-Fauna von Neu-Guinea und Neu-Britannien. *Archiv für Naturgeschichte* (A) 79 (1): 123–136.

Karny, H., 1913b. H. Sauter's Formosa-Ausbeute: Thysanoptera. *Supplementa Entomologica* 2: 127–134.

Karny, H., 1923. Beiträge zur malayischen Thysanopterenfauna. *Treubia* 3 (3–4): 277–380.

Morgan, A.C., 1913. New genera and species of Thysanoptera, with notes on distribution and food

plants. *Proceedings of the United States National Museum* 46: 1–55.

Moulton, D., 1928. The Thysanoptera of Japan: new species, notes, and a list of all known Japanese species. *Annotationes Zoologicae Japonenses* 11 (4): 287 — 337.

Mound, L.A., 1968. A review of R.S. Bagnall's Thysanoptera collections. *Bulletin of the British Museum (Natural History), Entomology Series*, Supplement 11: 3–181.

Mound, L.A. and Palmer, J.M., 1983. The generic and tribal classification of spore-feeding Thysanoptera (Phlaeothripidae: Idolothripinae). *Bulletin of the British Museum (Natural History), Entomology Series* 46 (1): 1–174.

Okajima, S., 1981. A revision of the tribe Plectrothripini of fungus-feeding Thysanoptera (Phlaeothripidae: Phlaeothripinae). *Systematic Entomology* 6: 291–336.

Okajima, S., 1990. The Old World species of *Pygothrips* (Thysanoptera: Phlaeothripidae). *Systematic Entomology* 15 (1): 87–99.

Palmer, J.M. and Mound, L.A., 1978. Nine genera of fungus-feeding Phlaeothripidae (Thysanoptera) from the Oriental Region. *Bulletin of the British Museum (Natural History), Entomology Series* 37 (5): 153–215.

Priesner, H., 1923. Ein Beitrag zur Kenntnis der Thysanopteren Surinams. *Tijdschrift voor Entomologie* 66: 88–111.

Priesner, H., 1929. Spolia mentawiensia: Thysanoptera. *Treubia* 11 (2): 187–210.

Priesner, H., 1932. Indomalayische Thysanopteren IV. *Konowia* 11 (1): 49–64.

Priesner, H. 1934. Indomalayische Thysanopteren (VI). *Natuurkundig Tijdschrift voor Nederlandsch-Indië* 94 (3): 254–290.

Priesner, H., 1936. Fünf neue *Taeniothrips*-Arten von Sumatra (Thysanoptera): *Treubia* 15 (3): 323–328.

Ramakrishna Ayyar, T.V. and Margabandhu, V., 1931. Notes on Indian Thysanoptera with brief descriptions of new species. *Journal of the Bombay Natural History Society* 34 (4): 1029–1040.

Schmutz, K., 1913. Zur Kenntnis der Thysanopterenfauna von Ceylon. *Sitzungs-Berichte der mathematisch-naturwissenschaftlichen Klasse der Akademie der Wissenschaften in Wien* (1) 122 (7): 991–1089.

Stannard, L.J. and Mitri, T.J., 1962. Preliminary studies on the *Tryphactothrips* complex in which *Anisopilothrips*, *Mesostenothrips*, and *Elixothrips* are erected as new genera (Thripidae: Heliothripinae). *Transactions of the American Entomological Society* 88: 183–224.

Thornton, I.W.B. and Rosengren, N.J., 1988. Zoological expeditions to the Krakatau Islands, 1984 and 1985: General Introduction. *Philosophical Transactions of the Royal Society of London* (B) 322: 273–316.

Walker, F., 1859. Characters of some apparently undescribed Ceylon insects. *Annals and Magazine of Natural History* (3) 4 (21): 217–224.

Wilson, T.H., 1972. *Apollothrips bhattii*, a new genus and species of thrips (Thysanoptera: Thripidae) from Central India, with a synopsis of related genera. *Annals of the Entomological Society of America* 65 (1): 49–54.

Wilson, T.H., 1975. A monograph of the subfamily Panchaetothripinae (Thysanoptera: Thripidae). *Memoirs of the American Entomological Institute* 23: 1–354.

zur Strassen, R., 1991. Report on the Thysanoptera (Insecta) collected on the 1984 Zoological Expedition to the Krakataus. *Treubia* 30 (2): 171–184.

Appendix

Synopsis of the Thysanoptera species from the 1984–1986 Zoological Expeditions to the four Krakatau islands in the Sunda Strait, Indonesia. (For records from the 1984 Expedition, see zur Strassen 1991.)

	Anak Krakatau	Panjang	Rakata	Sertung
Aeolothripidae				
Mymarothrips bicolor sp.nov.		+	+	
Thripidae				
Anisopilothrips venustulus (Priesner)		+		
Apollothrips bhattii Wilson		+		+
Apollothrips karnyi sp.nov.				+
Astrothrips globiceps (Karny)		+	+	+
Dorcadothrips trifasciatus (Priesner)			+	
Elixothrips brevisetis (Bagnall)		+		+
Lefroyothrips pr. *fasciatus* Moulton			+	
Megalurothrips formosae (Moulton)	+		+	+
Megalurothrips usitatus (Bagnall)	+			
Panchaetothrips holtmanni Wilson		+		+
Retithrips javanicus Karny			+	
Scirtothrips dorsalis Hood	+			
Selenothrips rubrocinctus (Giard)	+			
Thrips florum Schmutz			+	
Thrips hawaiiensis (Morgan)	+		+	
Thrips leeuweni (Priesner)			+	
Zonothrips karnyi Priesner	+			
Phlaeothripidae				
Dexiothrips madrasensis (Ananthakrishnan)				+
Dinothrips sumatrensis Bagnall			+	
Ecacanthothrips andrei Palmer and Mound			+	
Ecacanthothrips tibialis (Ashmead)		+	+	
Elaphrothrips curvipes Priesner	+			+
Ethirothrips stenomelas (F. Walker)		+	+	
Gigantothrips nigrodentatus (Karny)			+	
Haplothrips certus Priesner	+			
Haplothrips ganglbaueri Schmutz	+			
Haplothrips vernoniae Priesner	+			
Holurothrips ornatus Bagnall		+	+	+
Hoplandrothrips flavipes Bagnall			+	
Machatothrips antennatus (Bagnall)			+	
Machatothrips biuncinatus Bagnall			+	
Meiothrips menoni Ananthakrishnan		+	+	
Nesothrips brevicollis (Bagnall)	+	+		+
Nesothrips lativentris (Karny)	+	+	+	+
Plectrothrips eximius Ananthakrishnan	+		+	
Pygothrips vicinus Okajima				+
Strepterothrips orientalis Ananthakrishnan	+			
Streptothrips mirabilis Priesner			+	

Memoirs of the Museum of Victoria 53(1): 125–128 (1992)

RHOPTROMYRMEX RAWLINSONI SP. NOV., A NEW APPARENTLY WORKERLESS PARASITIC ANT FROM ANAK KRAKATAU, INDONESIA (HYMENOPTERA: FORMICIDAE: MYRMICINAE)

By Robert W. Taylor

Australian National Insect Collection, CSIRO Division of Entomology,
GPO Box 1700, Canberra, ACT 2601, Australia

Abstract

Taylor, R.W., 1992. *Rhoptromyrmex rawlinsoni* sp. nov., a new apparently workerless parasitic ant from Anak Krakatau, Indonesia (Hymenoptera: Formicidae: Myrmicinae). *Memoirs of the Museum of Victoria* 53: 125–128.

The alate-queen based *Rhoptromyrmex rawlinsoni* sp. nov. (Anak Krakatau I., Indonesia) is described and illustrated. It is presumed on morphological grounds to be a workerless parasite in the nests of another, unknown, ant species.

Introduction

Rhoptromyrmex is a tetramoriine ant genus comprising nine named species (Brown, 1964; Bolton, 1986). Three occur in the Indo-Australian area: *R. mayri* (Forel) is known only from India (Bolton, 1986), *R. melleus* (Emery) from Sulawesi east to New Britain and northern Cape York Peninsula, and *R. wroughtonii* Forel from southern India eastwards to the Philippines, New Guinea and Cape York Peninsula (Taylor, 1991).

All known *Rhoptromyrmex* queens possess characteristics associated with social parasitism. Their combinations establish the stages of an "anatomical parasitic syndrome" (see Wilson, 1984 and Bolton, 1986, extending the hypotheses of Brown, 1964). *R. mayri* and *R. schmitzi* (which is known only from Israel) are almost certainly workerless parasites of other ants (*Pheidole latinoda* Roger and *Tapinoma erraticum* (Latreille) respectively). *R. wroughtonii* apparently disseminates by autoparasitism followed by polygyny and colony fission. Other species, including *R. melleus*, have morphological characteristics implying colony foundation by temporary social parasitism.

Queens are not always morphologically characterised in keeping with their presumptive reproductive/parasitic roles, and the workerless parasites are no more particularly distinctive than some putatively autoparasitic or free-living forms. Reproductive females which are not associated with conspecific workers, or those of an obvious host, thus often cannot be placed confidently in the reproductive/parasitic spectrum.

On the basis of similarities to *R. schmitzi* and *R. mayri* the alate queen described here is presumed to be a further workerless inquiline found normally in the nests of some other ant species.

Given the circumstances of collection (from a flight-intercepting water trap) *R. rawlinsoni* is not certainly resident on Anak Krakatau. Its established presence somewhere in the Krakatau island group is reasonably assumed, despite the proximity of Sumatra and Java, from which the type could have originated. Residence will be confirmed only by collection of a further specimen from a host colony.

Rhoptromyrmex rawlinsoni sp. nov.

Figures 1–4

Type material. Unique holotype, collected on the southwest shore of Anak Krakatau (06°66′S;105°26′E), Indonesia from a water trap set by members of the 1985 Krakatau Zoological Expedition, co-ordinated by Prof I.W.B. Thornton, La Trobe University, Melbourne. The label bears the numbers 211 LW, and 31 (the latter in a small circle), and is dated 14–24/8/85. Deposited in Research and Development Centre for Biology, Bogor, Indonesia. The specimen has been gold coated for scanning electron microscopy. The detached wings are preserved in glycerin in an attached microvial.

Description of reproductive female. General features as illustrated. Dimensions (mm) as follows: aggregate total length *c.* 2.7; head width (across eyes) 0.56; head length (maximum, including clypeal projection) 0.59; scape length (maximum measurable chord length) 0.38; mesosoma length (lateral view, direct measurement from


1
2
3
4

base of pronotal collar to posterolateral extremity of mesosoma) 0.72; pronotum width 0.42; petiolar node width 0.15; postpetiole width 0.26.

Mandibles subfalcate, masticatory margins strongly oblique, each armed only with strong apical tooth and small, reclinate, subapical denticle; apical tooth aligned with main axis of mandibular shaft, not down-turned. Antennae 12-segmented; scapes very slightly exceeding occipital corners when appropriately positioned. Anteromedian border of clypeus greatly extended to form broad, anterodorsally inclined, translucent tongue-like process (Figs 1, 2, 4). Palpal formula unknown (labio-maxillary complex of holotype retracted). General cranial proportions in full face view much as in *R. mayri*, the eyes proportionately a little larger. Occipital border shallowly concave at centre, occipital corners broadly rounded. Ventral outline of head concave in side view. Postgenae each shallowly longitudinally concave; 2 resulting depressed troughs separated by broad, low, raised longitudinal tumosity centred at midline on genal suture (near-side concavity and raised midline profile visible in Fig. 4). Mesosoma elongate and narrow, lacking notaulices; parapsidal lines vestigial. Posterodorsal propodeal outline in profile a continuous, slightly convex curve. Propodeum unarmed, but with fine carina on each side running upwards from metapleural lobe to about level of spiracle. Metapleural lobes barely raised, inconspicuous. Petiole in dorsal view narrow; nodal section only slightly broader than peduncle. Postpetiole quite strongly transverse. Petiolar node in profile as in fig. 4, not flattened above; subpetiolar keel relatively large. Subpostpetiolar process transverse, moderately large and acutely triangular in lateral view; its anterior face approximately triangular, slightly concave, submarginate on each side.

Forewing veins extremely faint, especially posteriorly. Venation reduced compared to *R. wroughtonii* (as illustrated by Bolton, 1986); discoidal cell open apically (no cross-vein m-cu); radial cell closed; vein r-m + Mf lacking.

Eyes bearing a few scattered, erect, fine hairs with average length about twice diameter of single facet. Dorsal surfaces of head, mesosoma (including sides of pronotum, and entire propodeum), nodes and gaster with abundant, long, erect to suberect hairs; longest on nodes, gaster and frons. Postpetiole and gaster ventrally with similar but shorter and less-dense hairs. Mandibles, clypeus, frons anterior to eyes, postgenae, sides of pronotum and mesothorax, and ventral half or so of petiole, essentially hairless. Antennae densely pilose, hairs shorter and finer than elsewhere; legs similarly but less densely hirsute. Pubescence virtually absent.

Sculpturing little-developed except for few broken, concentric, semicircular striae behind the antennal insertions (Fig. 2), and scattered pilosity-bearing punctures, which are relatively large on the frons, and finest on gaster and nodes; spaces between punctures almost everywhere strongly shining. Non-pilose areas specified above smooth and highly reflective, lacking sculpturing. Propodeum less shining than elsewhere, lightly and somewhat irregularly rugose.

General colour dull, medium golden-brown, gaster a shade darker. Mandibles, legs and clypeal process concolorous, lighter golden-brown. Hairs yellowish.

Etymology. Named to honour the noted biologist Peter Rawlinson who tragically died on Anak during the latest Australian Krakatau Expedition, April 1991.

Notes. Apart from its distinctive clypeal process, and the transverse postpetiole, *R. rawlinsoni* largely resembles *R. schmitzi*. It differs in similar fashion from *R. mayri*, but that species has triangular mandibles. No modifications to the latest generic diagnosis (Bolton, 1986) are required, apart from mention of the clypeal process described here.

Workers identified as *Rhoptromyrmex wroughtonii* have been taken (by the 1985 expedition) on Anak Krakatau, making this species a possible host to *R. rawlinsoni*.

Several *Rhoptromyrmex* species, including *R. melleus* and the African species *R. opacus* Emery and *R. transversinodis* Mayr, were considered by Brown (1964) to exhibit polymorphism in the reproductive female. Each case depends on a presumption of conspecificity based on similarities among workers associated with the several relevant female 'morphs'. It is equally plausible to assume non-conspecificity based on female differences. This would imply the existence of *Rhoptromyrmex* species among which reproductive females are more easily distinguished than workers, and could challenge some current synonymies among worker-based taxa. Also, some species might serve as hosts to alien congeneric parasitic females similar to their own, which could be confused as conspecific with the host workers in parasitized colonies (and which might not be plausibly recognized as alien unless queens of two or more kinds were taken together

in colonies). I suggest that current species-level synonymy in *Rhoptromyrmex* could be excessive, obscuring a greater underlying species richness, and that workerless parasitic species might be more numerous than currently assumed.

References

Bolton, B., 1986. A taxonomic and biological review of the tetramoriine ant genus *Rhoptromyrmex* (Hymenoptera: Formicidae). *Systematic Entomology* 11: 1–17.

Brown, W.L. Jr., 1964. Genus *Rhoptromyrmex*, revision of, and key to species (Insecta: Hymenoptera: Formicidae). *Pilot Register of Zoology*, Cards 11 to 19.

Taylor, R.W., 1991. Nomenclature and distribution of some Australasian ants of the subfamily Myrmicinae (Hymenoptera: Formicidae). *Memoirs of the Queensland Museum* 30 (3): 599–614.

Wilson, E.O., 1984. Tropical social parasites in the ant genus *Pheidole*, with an analysis of the anatomical parasitic syndrome (Hymenoptera: Formicidae). *Insectes Sociaux* 31: 316–334.

Memoirs of the Museum of Victoria 53(1): 129–133 (1992)

PARONELLID COLLEMBOLA COLLECTED BY THE KRAKATAU EXPEDITION, 1984

By Ryozo Yoshii

637–5 Shokokuji Monzencho, Kyoto, Japan

Abstract

Yoshii, R., 1992. Paronellid Collembola collected by the Krakatau Expedition, 1984. *Memoirs of the Museum of Victoria* 53: 129–133.

Nine species of paronellid Collembola have been identified from collections made on the Krakatau expedition in 1984. All species but one have been described previously. A new subgenus and a species of *Callyntrura, C.* (*Javaphysa*) *javana* are described and a previously insuffiently described species of *Salina, S.* (*Salina*) *obscura* (Handschin), is redescribed. A key to subgenera of *Callyntrura* is presented.

Introduction

Until now, only one species of Collembola had been recorded from the Krakatau Islands. This was *Lepidosira calolepsis* (Börner) recorded as *Mesira calolepsis* by Womersley (1932). At the time it was said to be abundant "on the small island produced in 1929 . . . some 3 miles from Krakatau itself". This island is now known as Anak Krakatau.

A collection of Collembola was made from Java, Sumatra and the Krakatau Islands during the 1984 Krakatau expedition. A full report of the expedition was given by Thornton and Rosengren (1988). In the collection of paronellid specimens sent to me by Ms Penelope Greenslade were nine species, six newly recorded from the Krakatau Islands. Eight of the species were already described but one new species of *Calyntrura* belonging to a new subgenus was present in samples from west Java. It is described together with another insuffiently described by Handschin (1925). The other seven species are also listed. Full synonomies for all previously described species were given by Suhardjono (1989) and the system of setal nomenclature followed is that given by Yoshii (1981, 1982 and 1983).

Most material is deposited in the South Australian Museum, Adelaide (SAMA) and representative specimens lodged in the Bogor Museum, Bogor, Java, Indonesia (BM).

Salina (Salina) celebensis (Schäffer)

Cremastocephalus celebensis Schäffer, 1898: 407. — Handschin, 1928: 250.

Salina celebensis. — Yoshii, 1981: 46. — 1983: 17.

Material examined. Sumatra, Liwa, SAMA (3 specimens). Krakatau, SAMA (12), BM (2). West Java, Ujing Kulon, SAMA (6), BM (2). Bogor, SAMA (1).

Distribution. The species has an almost circumtropical distribution (Pacific Islands, Australia and Africa) as well as occurring in Japan and Formosa.

Salina (Salina) obscura (Handschin)

Figure 1

Cremastocephalus obscurus Handschin, 1925: 249.

Material examined. Sumatra, Liwa, SAMA (1), BM (1).

Description. Body length *c.* 1.8 mm. Ground colour whitish, beautifully adorned with purplish bands and spots (Fig. 1A). Head with longitudinal patch along sides, continuing along trunk on lateral margin up to abd. III. Short transverse branch marginally on th. II, III and abd. I, II, while abd. III has 3+3 patches of which 2+2 are on posterior part and elongated into broad bands. Abd. IV with large patch anterolaterally and another posteriorly near end of segment, with another patch medially. Abd. V deeply edged with pigment posteriorly and at sides. Abd. VI only with lateral patch. Antennae with longitudinal streak laterally. Legs irregularly patched on coxa and trochanter, femur and tibiotarsus each with 2 deep bands at middle. Ventral tube and furca pale. Ratio ant. : head, 15:10. Eyes 8+8 (Fig. 1C), poorly pigmented, G, H much smaller than other 6. Frontal spine present. Labral setae (Fig. 1B) 4/5, 5, 4, prelabrals barbed. Outer max. lobe with setae 2/II+3. proximal 2 barbed, basal seta of papilla straight, thick, but almost pointed apically. Setae of labial basis as M–E/LL, R absent. Legs elongate,

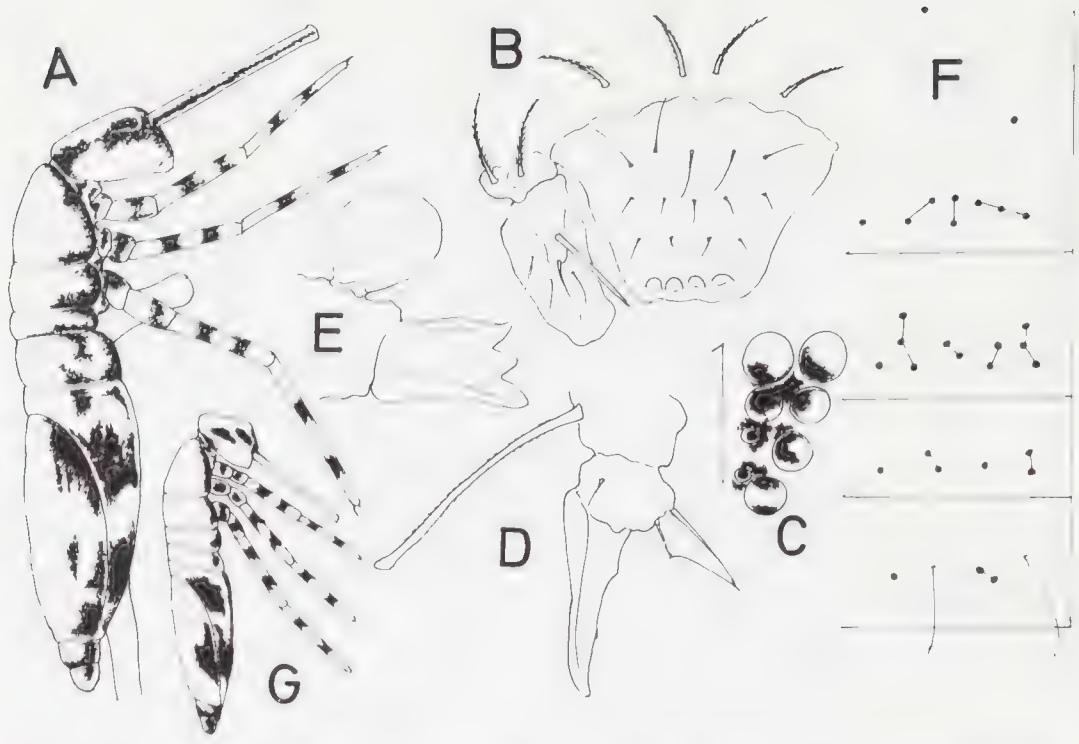


Figure 1. *Salina obscura* (Handschin). A, habitus. B, labrum and outer max. lobe. C, eyes. D, hind claw. E, mucro. F, macrochaetal pattern. G, colour pattern reconstructed from the description of Handschin (1925).

unguis (Fig. 1D) with 1 inner tooth near distal end, unguiculus truncate. Tenent hair very long, spathulate distally and finely ciliated. Trochanteral organ with *c.* 25 spinules in triangular area. Ventral tube not well investigated, but lateral flap with *c.* 10 longer, smooth and *c.* 5 smaller, ciliated setae. Furca with manubrium : dens ratio, 10:14, both without modification. Dental vesicle (Fig. 1E) conspicuously large. Mucro small, tridentate as normal for genus. Macrochaetotaxy of trunk as in Fig. 1F, with chaetotactic formula of s/2/s/1 only for abd. II (juvenile pattern not known).

Remarks. These examples were found near the type locality "Wai Lima", Sumatra. There is no figure of this species in Handschin's (1928) monograph but the examples coincide well with the description. I have reconstructed the habitus (Fig. 1G) which the specimens in the expedition's collections match.

Distribution. Sumatra.

Salina pallens Yoshii

Salina pallens Yoshii, 1981: 48. — Yoshii and Suhardjono, 1989: 67.

Material examined. Krakatau, SAMA (5 specimens). Ujung Kulon, SAMA (10), BM (2).

Remarks. This species is easily distinguished from *Salina celebensis* by the number of prelabral setae, reduced to 2 instead of the usual 4.

Distribution. Borneo, Java, Lombok, Sulawesi, Ivory Coast (West Africa).

Salina sp.

Material examined. Sumatra, SAMA (7). Krakatau, SAMA (6). Ujung Kulon, SAMA (4).

Remarks. The examples are juveniles and could not be identified.

Callyntrura (Murphysa) vestita (Handschin)

Paronella vestita Handschin, 1925: 257.
Callyntrura vestita. — Yoshii, 1982: 19.

Material examined. Krakatau, SAMA (1).

Remarks. The species was only known from western Java until now.

Distribution. West Java, Krakatau Is.

Callyntrura (Murphysa) tarsata (Börner)

Paronella tarsata Börner, 1906: 177.
Callyntrura tarsata. — Yoshii, 1982: 20.

Material examined. Sumatra, Liwa, SAMA (10). Krakatau, SAMA (10). West Java, Ujung Kulon, SAMA (3), BM (1).

Remarks. The species seems to be common in the region. As the colour pattern and the chaetal arrangement are very constant, it is easily identified.

Callyntrura (Javaphysa) subgen. nov.

Diagnosis. Differing from *Murphysa* Yoshii in being without a real dental vesicle and with well developed macrochaetotaxy. Differing from *Istanaphysa* Yoshii in presence of distal swelling of dens.

Type species. Callyntrura (Javaphysa) javana sp. nov.

Key to subgenera of *Callyntrura*

1.	Prelabral setae barbed	2
—	Prelabral setae smooth	9
2.	First row of labral setae modified	3
—	Three median setae of the first row modified	4
—	No labral setae modified	*Japonphysa*
3.	Distal vesicle of dens present	*Gunungphysa*
—	Distal vesicle of dens absent	*Borneaphysa*
4.	Distal vesicle of dens absent	5
—	Distal vesicle of dens present	6
5.	Terminal tubules of ventral tube with single row of papillae or warts	*Javaphysa*
—	Terminal tubules of ventral tube smooth	*Istanaphysa*
6.	Antennae long, without scales	*Callyntrura*
—	Antennae short, with scales	7
7.	Dental spines present	*Murphysa*
—	Dental spines absent	8
8.	Terminal tubules of ventral tube with many papillae or warts	*Batikphysa*
—	Terminal tubules of ventral tube with smooth walls	*Kudatphysa*
9.	Antennna IV long, basal seta of outer maxillary lobe blunt	10
—	Antennae IV short, basal seta setaceous, pointed	*Dicraocentroides*
10.	Frontal area with 3 + 3 spinules, dens without small vesicle	*Sultanaphysa*
—	Frontal area with 4 + 4 spinules, dens with a small vesicle	*Pterikrypta*

Callyntrura (Javaphysa) javana sp. nov.

Figure 2

Material examined. Holotype: Java, Gunung Payung, Ujung Kulon, 21 Sep ?1985, SAMA (I.22607).

Paratypes: Same locality and collecting data as holotype, SAMA (1), BM (1 juvenile).

Description. Body length *c.* 2.5 mm, ground colour brownish white, with light spots on frontal area and clypeus. Transverse band present on abd. III not extending posteriorly. Trunk laterally lightly shaded, including antennae and dens. Legs with conspicuous black patch on femur near distal end. Tibiotarsi also with 2 light bands. Ratio ant.I : head, 23:10. Ant. I and II densely beset with setae and those of dorsal side flattened (Fig. 2A), narrowly fusiform and almost scaly in appearance. Eyes 8+8, equally large and black. Frontal spines 2+2, distinctly brownish. Labrum (Fig. 2B) with setae 4/5,5,4, prelabrals barbed, from first row of setae; median 3 straight and blunt ending, lateral pair curving, slender and pointed. Labral margin without structure. Outer max. lobe with setae 2/II+3, basal seta of papilla blunt ending. Labial basis (Fig. 2C) with setae MRe/lL. Legs elongate, unscaled. Unguis with 2 faint inner teeth, paired lateral teeth well developed, larger than dorsal tooth. Unguiculus obliquely truncate. Tenent hair shorter than unguis, distally spathulate. Trochanteral organ well developed, composed of *c.* 50 spinules, thicker on anterior side. Ventral tube elongate, unscaled. Anterior side with some ciliated setae, distal ones larger and

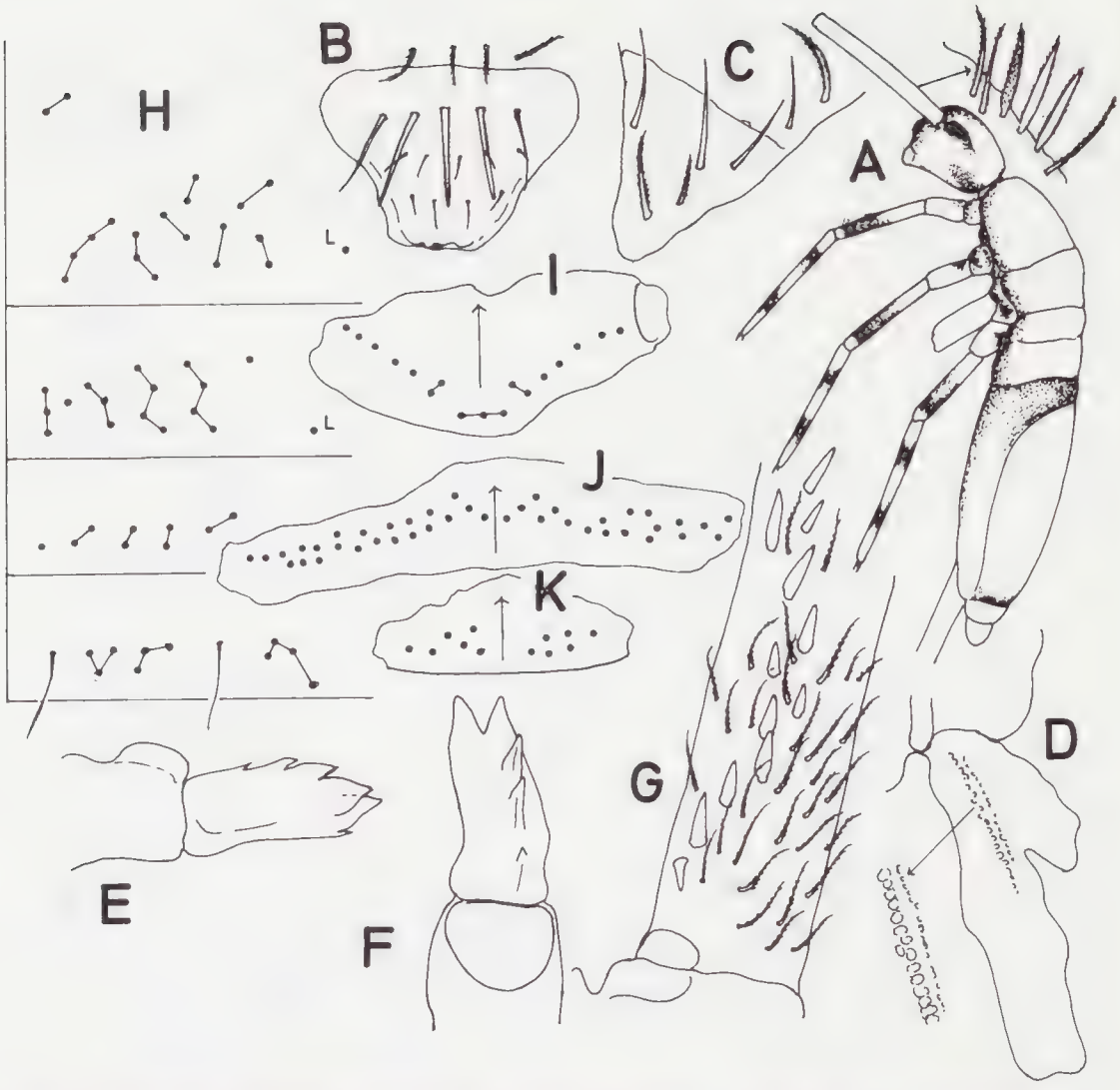


Figure 2. *Callyntrura* (*Javaphysa*) *javana* sp. nov. A, habitus. B, labrum. C, labial basis. D, terminal tubule. E, F, distal end of dens and mucro (lateral and dorsal view). G, dental spines. H, macrochaetotaxy of trunk. I, ditto of vertex. J, K, ditto of abd. IV (median and posterior group).

brownish. Posterior side densely covered with short, ciliated setae, distal 1+1 smooth and with 1 median seta almost like s. s. proximally. Lateral flap with some larger smooth and shorter ciliated setae. Terminal tubule (Fig. 2D) with row of minute granules or papillae in basal half, not easily distinguished. Manubrium : dens, 10:18. Manubrium scaled only ventrally, dorsally equally setose except glabrous median streak. Dens (Fig. 2G) with up to 18 distinctly short spines proximally on inner dorsal side, arranged in 1 irregular row. Distal setae not modified. Dental distal vesicle absent, but in lateral view (Fig. 2E), small swelling of terminal portion of dens visible (dental vesicle should therefore be searched for in dorsal view) (Fig. 2F). Mucro typically with 6 teeth, including 1 inner and 4 dorsal teeth. Head with complete setae of vertical group (Fig. 2I); those of trunk as in Fig. 2H, where abd. I has *c.* 9+9 setae in 2 rows

and abd. II has setae s/6/s/4; median group of abd. IV (Fig. 2J) almost at single level and distal group (Fig. 2K) few in number.

Remarks. The species is similar to *C. tarsata* Börner in the appearance of the patched legs, the transverse band of abd. II being sometimes obsolete. However, it is readily distinguished from it by the fully developed macrosetae of the head and trunk. The absence of the dental vesicle is also characteristic. In one juvenile example (1.5 mm) the macrosetae are well represented, the dental spines are absent but the distal swelling (not the vesicle) of the dens is distinguishable.

Distribution. West Java.

Callyntrura (Batikphysa) quadrimaculata Yoshii and Suhardjono

Callyntrura quadrimaculata Yoshii and Suhardjono, 1989: 80.

Material examined. West Java, Pulau Peucang, Ujung Kulon, 31 Aug 1985. SAMA (3), BM (2). Krakatau, BM (1).

Remarks. The examples coincide well with the description of the species from Central Java in both colour pattern and morphological details. In one darker specimen the two patches on abd. IV are nearly united dorsally.

Distribution. Java, Krakatau Is.

Bromacanthus setigerus (Börner)

Paronella setigera Börner, 1906: 178.
Pseudoparonella setigera. — Handschin, 1925: 254.
Bromacanthus setigerus. — Yoshii, 1981: 41.

Material examined. Sumatra, Liwa, SAMA (4).

Distribution. This is a widely distributed species in tropical Asia, already known from Singapore, Borneo, Sulawesi, Java, Moluccas Is. and other places.

Discussion

Of the nine species of paronellid Collembola recorded in this paper six were found on the Krakatau Islands, five on Sumatra and six in west Java. None were found only in the Krakataus. This collection certainly represents only a small proportion of the paronellids actually present in the three regions since only one method, beating and sweeping vegetation, was used and collections were made in the course of general insect collecting without any particular effort being made to comprehensively sample Collembola. Suhardjono's (1989) check list of Collembola from Indonesia and adjacent regions recorded 77 species of paronellid. It is to be expected therefore, that more species will be found, even in the Krakatau Islands, when collecting effort is concentrated on this group alone.

Acknowledgements

I thank Ms P. Greenslade for kindly sorting out the specimens and reviewing the manuscript and Professor Thornton and colleagues for collecting the material.

References

Börner, C., 1906. Das System der Collembolen. *Mitteilungen aus der naturhistorischen Museum, Hamburg* 23: 147–188.

Börner, C., 1913. Zur Collembolenfauna Javas. *Tijdschrift voor Entomologie* 56: 44–61.

Handschin, E., 1925. Beiträge zur Collembolenfauna der Sundainseln. *Treubia* 6: 225–270.

Handschin, E., 1928. Collembolen aus Java, nebst einem Beitrag zu einer Monographie der Gattung *Cremastocephalus. Treubia* 10: 245–270.

Schäffer, C., 1898. Die Collembola des Bismark-Archipels nach des Ausbente von Dr F. Dahl. *Archiv für Naturgeschichte* 64: 393–425.

Suhardjono, Y.R., 1989. Revised check list of Collembola from Indonesia and its adjacent regions. *Azao* 1: 1–23.

Thornton, I.W.B. and Rosengren, N.J., 1988. Zoological expeditions to the Krakatau Islands, 1984 and 1985: general introduction. *Philosophical Transactions of the Royal Society of London* B 322: 273–316.

Womersley, H., 1932. Collembola from Krakatau. *Entomologist's Monthly Magazine* 68: 88.

Yoshii, R., 1981 Paronellid Collembola of Sabah. *Entomological Report of the Sabah Forest Research Centre* 3: 51 pp.

Yoshii, R., 1982. Studies on the collembolan genus *Callyntrura* and *Dicranocentroides. Entomological Report of the Sabah Forest Research Centre* 6: 38 pp.

Yoshii, R., 1983. Studies on paronellid Collembola of East Asia. *Entomological Report of the Sabah Forest Research Centre* 7: 28 pp.

Yoshii, R. and Suhardjono, Y.R. 1989. Notes on the collembolan fauna of Indonesia and its vicinities. *Azao* 1: 23–90.

Memoirs of the Museum of Victoria 53(1): 135 (1992)

REPLACEMENT NAME FOR *LYRIA MITRAEFORMIS CRASSICOSTATA* DARRAGH, 1989

By Thomas A. Darragh

Natural History Division, Museum of Victoria, 285 Russell Street, Melbourne, Victoria 3000, Australia

Abstract

Darragh, T.A., 1992. Replacement name for *Lyria mitraeformis crassicostata* Darragh, 1989. *Memoirs of the Museum of Victoria* 53: 135.

Lyria mitraeformis ovicampestris Darragh nom. nov. is erected for the junior homonym, *Lyria mitraeformis crassicostata* Darragh, 1989.

Lyria mitraeformis crassicostata was described by the author (Darragh, 1989) from the late Pliocene Roe Calcarenite, Roe Plain, Western Australia. The combination *Lyria crassicostata* has been used by Stoliczka (1867) for a species from the late Cretaceous of South India. The name of the Western Australian species is a junior primary homonym and therefore must be replaced. I am grateful to Mr G.W. Kendrick of the Western Australian Museum for drawing my attention to this homonymy.

Lyria mitraeformis ovicampestris
Darragh nom. nov.

Lyria mitraeformis crassicostata Darragh, 1989: 212, pl. 28, figs 7–12. Non *Lyria crassicostata* Stoliczka, 1867: 98, pl. 9, fig 9.

References

Darragh, T.A., 1989. A revision of the Tertiary Volutidae (Mollusca: Gastropoda) of south-eastern Australia. *Memoirs of the Museum of Victoria* 49(2): 195–307, pls 1–30, figs 1–31. (The date of publication though printed as 30 November 1988 was 6 February 1989).

Stoliczka, F., 1867. Cretaceous Fauna of Southern India. Vol. 2 (1–4) The Gastropoda, pp. 1–204, pls 1–16. *Memoirs of the Geological Survey of India Palaeontologia Indica.*

CONTENTS

Paracalliope, a genus of Australian shorelines (Crustacea: Amphipoda: Paracalliopiidae).
J. L. Barnard and M. M. Drummond 1

A new species of *Pagurixus* (Crustacea: Decapoda: Paguridae) from southern Australia.
S. W. Gunn and Gary J. Morgan 31

Revision of *Pylopagurus* and *Tomopagurus* (Crustacea: Decapoda: Paguridae), with the descriptions of new genera and species. Part IV. *Lophopagurus* McLaughlin and *Australeremus* McLaughlin.
Patsy A. McLaughlin and S. W. Gunn 43

Revision of the genus *Cheiloxena* Baly (Coleoptera: Chrysomelidae: Eumolpinae).
C. A. M. Reid 101

Thysanoptera (Insecta) from the 1985 and 1986 Zoological Expeditions to the Krakataus, Indonesia.
Richard zur Strassen 115

Rhoptromyrmex rawlinsoni sp. nov., a new apparently workerless parasitic ant from Anak Krakatau, Indonesia (Hymenoptera: Formicidae: Myrmicinae).
Robert W. Taylor 125

Paronellid Collembola collected by the Krakatau Expedition, 1984.
Ryozo Yoshii 129

Replacement name for *Lyria mitraeformis crassicostata* Darragh, 1989.
Thomas A. Darragh 135